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4 February 1986

Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

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WORLDWIDE REPORT

NUCLEAR DEVELOPMENT AND PROLIFERATION

CONTENTS

VIETNAM

U.S.-BUILT NUCLEAR REACTOR OPERATION, USSR ASSISTANCE DESCRIBED

Vientiane PASASON in Lao 6 Nov 85 p 3

[Article by Keosuvan: "Vietnam: Progress in Nuclear Energy To Serve Economic Zones"]

[Text] Before liberation, in southern Vietnam, the American imperialists established an atomic research center for the purpose of developing nuclear weapons to kill the people of Vietnam. But the moral side won the victory. Under the leadership of the Communist Party of Vietnam, the people of Vietnam eliminated the neocolonial administrative system implemented by the United States and built a new life for themselves. The cadres at the Atomic Research Center, which is located at Dalat in southern Vietnam, changed the direction of the research. Now, they are trying to develop atomic energy to help restore the economy.

In close cooperation with Soviet experts, the cadres and workers have restored and increased the capacity of the nuclear reactor and taken measures to protect the environment from radiation. It can be said that everything has been completely rebuilt. The original foundation could not be used. After 2 years of construction, the tests done on the increased capacity of the reactor showed that the reactor was capable of meeting the plan's objectives. For the first time, an automatic operating and warning system was installed. This system is operating normally, and there is good protection from the high radiation. This system, together with the various techniques developed by the Dalat Atomic Research Center, is the heart of the reactor.

The components of the heat transmission system were maintained by crossing the currents of the old "talika" reactor. Using WR-M type fuel rods and other technical methods, the planners increased the capacity of the reactor to 400 kilowatts. The reactor's neutron flux is measured at a neutron current of 20,000 billion per square centimeter per second. This value is the highest value. But the important thing is that this can ensure the efficiency and stability of various activities. The important task of the Atomic Research Center is to conduct geological studies and do research on the agricultural environment, industry, public health and so on. Besides that, the Atomic Research Center has succeeded in generating electricity using nuclear power for several areas in Dalat. At present, the scientific cadres at the center have formulated basic plans and organization for generating low-power

radiation, that is, Beta ph 32, which will be used in large hospitals such as those in Hanoi and Ho Chi Minh City. Besides this, they have produced TC-99 [Technetium], which is a type of radiation that is used quite often in studying diseases. The scientific and technical base of agricultural industry and other matters have been studied and tested at this center. In the future, the Dalat Atomic Research Center will become a major research center for the study and use of nuclear energy. Nuclear energy will be used to expand the economy of Vietnam in a more efficient manner. The achievements mentioned above have been scored with the help of the Soviet Nuclear Energy Organization, which has constantly monitored things closely and given guidance. This also shows that only the fraternal socialist countries have a spirit of proletarian internationalism. They have constantly given support on all fronts regardless of the difficulties encountered.

11943
CSO: 5100/4303

YUGOSLAVIA

OPPOSITION TO NUCLEAR POWER PLANT DEVELOPMENT

LD190540 Belgrade TANJUG in English 0353 GMT 19 Dec 85

/Daily feature by Dusan Zupan: "Yugoslav Dilemmas--Nuclear Power Plants, Yes or No"/

/Text/ Belgrade, 19 Dec (TANJUG)--Polemic about nuclear power plants is in full swing in Yugoslavia. The expert and political circles, and the general public, are vehemently arguing for or against the building of nuclear power plants in future.

The immediate cause of the polemic is a recently announced public bidding for the building of two 1,000 mw nuclear power plants by the end of the century, and another two of the same capacity the construction of which is to start in the year 2000.

Firms from the United States, the Federal Republic of Germany, Italy, Canada, France and Japan have already paid the 20,000 dollar tender price, and the Soviet Union is expected to send in a tender too.

The supporters argue that Yugoslavia cannot wait for better times as its energy resources are very limited. They maintain that it is high time the Yugoslav science and technology become more engaged in nuclear technology projects, and see the buidling of nuclear power plants as a chance for the domestic industry and construction sector to expand activity in which, according to their estimates, the domestic participation could account for even 60 percent.

They refute the arguments of the opponents who warn of the environmental pollution, the short working life of nuclear power plants and potential dangers of uranium waste by quoting a well-known Yugoslav academician who said "the opponents of nuclear energy resemble those Red Indians who dreaded the iron horse."

More convincing, for the average Yuoslav citizen at least, are the arguments of the opponents, although both sides use diametrically opposed date on the country's energy potentials in trying to corroborate their stands. Thus the opponents of nuclear power plants say that Yugoslavia has coal reserves for at least a hundred coming years and, consequently, no reason to rush with the decision. Furthermore, they say, the country's water potentials are far from

being adequately used, not to mention the possibilities opening with solar energy, biomasses and other energy sources. As huge amounts of money are involved anyway, it is much better to invest it to further develop the existing methods of energy production, master new and cleaner technologies, and develop technologies which can save up to 15 percent energy, they say.

Yugoslavia cannot afford the luxury of building nuclear power plants now that their building has almost entirely stopped in the world and even the already commenced construction has been suspended, the opponents argue. They propose that Yugoslavia proclaim a moratorium until the year 2010, as the Scandinavian and some other countries have done.

One of the opponents' chief arguments is of political nature. What will happen if Yugoslavia runs short of uranium fuel, will it become dependent on foreign countries for uranium, the big powers above all, they ask the embarrassing question to which no precise answer has yet been given.

The opponents' retort the "iron horse" argument by saying that more fitting for nuclear energy supporters are the words "apres moi le deluge," alluding to the harmful consequences for Yugoslav generations to come.

The final decision on the construction of new nuclear power plants will be taken by the Federal Government next year, at a recommendation by a special expert commission. It is believed that the decision will also be influenced by the country's material potentials since the four nuclear power plants would cost some 15 billion dollars at the current prices.

It remains to be seen how successful either side will be in the effort to win the public for their arguments, as this is also an element which the Federal Government must take into account.

/12228
CSO: 5100/3012

INTER-AMERICAN AFFAIRS

ARGENTINA TO AID PERU IN PRODUCTION OF RADIOISOTOPES

Lima EL COMERCIO in Spanish 9 Dec 85 p A-6

[Text] Starting in 1987, Peru will be able to begin producing radioactive isotopes for agricultural, medical, and industrial use. This will be made possible through a new nuclear energy agreement signed by our country with Argentina.

By means of this agreement, Peru has assured the completion of its Huarangal complex, as well as studies of uranium mines in Puno and the construction of a pilot plant with an approximate annual production of 30 tons of uranium. The agreement also covers the completion of the "ten" power reactor.

The engineer Alberto Constantini, head of Argentina's National Atomic Energy Commission, made this announcement yesterday, shortly before leaving to return to his country. The agreement, which has no termination date, was signed by the head of the IPEN [Peruvian Nuclear Energy Institute], Gen Juan Barreda Delgado.

Constantini reported that the new Peruvian-Argentine nuclear energy accord offers clear proof that they are working together for the benefit of both nations. He said that, as Argentina and Peru are countries with a peaceful tradition, their development of nuclear energy has no other intent but for peaceful purposes.

Puno Uranium: a Great Future

Under this agreement, Argentina will conduct studies of the uranium mines in Puno. He indidated that a pilot plant will be built, to produce about 30 tons of uranium a year.

As for the Huarangal complex, the accord ensures its completion, the technical training of its personnel, and the completion of the "ten" power reactor. According to Constantini, Peru will be able to start producing radioisotopes within the next 12 months, but its full production potential could be reached within 30 months.

He added that all the economic problems left unresolved from the previous agreement have been worked out. "Personally, I feel that this new agreement will be beneficial for both Peru and Argentina, countries united by eternal ties of friendship," he said at the airport shortly before boarding his flight to return to Buenos Aires.

The Argentine Program

"Despite the present economic climate, Argentina has earmarked $600 million for its nuclear energy program for next year," said Constantini. Two plants--of 150 MW and 300 MW power--are in full operation.

A third plant is under construction, and is 40 percent completed. Finally, a fourth nuclear power plant is now planned. "We want the world to know that our nuclear energy program is a peaceful one. We are thinking of the well-being of our peoples. We have definitely discarded any option of military use," he said upon departing.

7679
CSO: 5100/2030

ARGENTINA

UNION SAYS NUCLEAR DEVELOPMENT IN DANGER

PY021405 Buenos Aires NOTICIAS ARGENTINAS in Spanish 2055 GMT 1 Jan 86

[Text] Buenos Aires, 1 Jan (NA) -- The ENACE [Argentine Nuclear Enterprise for Electrical Power Plants] trade union has warned that nuclear development in the country "is on the brink of collapse," thus threatening "our capability for making autonomous political decisions." ENACE stated that "budgetary cuts and especially a lack of interest in independent nuclear development are endangering scientific-technical and economic activity in the immediate and long-term future." ENACE added that "these problems, which would be serious in any industry, could have a disastrous effect on areas such as power supply and nuclear plants and on our capability for making autonomous political decisions."

The ENACE union expressed its position in a communique signed by its press secretary, Fernando Bujan.

"The efforts of the Argentine people for over 30 years have yielded results in nuclear development of a magnitude unparalleled by those achieved in any other industry," the ENACE communique stated. In this regard, the communique warned that "a situation now prevails in which everything thus far achieved in production and research facilities, equipment, and training of international caliber scientific-technical personnel is being thrown overboard."

The communique added: "Besides the paralysis affecting the National Commission for Atomic Energy [CNEA], there are 100 percent delays in the third nuclear power plant, Atucha II, the construction of which is the responsibility of ENACE." For ENACE, "this involves nonproductive cost increases for which requests for millions of australes are quickly being processed," according to the communique.

"Low salaries and instability have prompted the departure of workers, whose training has required an investment of many years and much money, to increase at an alarming rate," the communique added. "In the case of ENACE, the workers leaving the country could be replaced by foreign personnel, but at a cost ratio of about 7-to-1 in comparison to domestic personnel."

"The combination of ENACE's business irresponsibility and ENACE and CNEA's dependent and socially insensitive thinking are causing a dismantling of nuclear activities in our fatherland," according to the communique. In keeping with this, the ENACE communique urges "that those who through sabotage or the misery of the workers want to do away with the possibility of achieving independent nuclear development be stopped."

/9274
CSO: 5100/2034

ARGENTINA

CNEA CHAIRMAN SAYS UNION STATEMENT 'IRRESPONSIBLE'

PY031657 Buenos Aires NOTICIAS ARGENTINAS in Spanish 2153 GMT 2 Jan 86

[Text] Buenos Aires, 2 Jan (NA) -- National Commission for Atomic Energy (CNEA) Chairman Alberto Constantini today termed "irresponsible" a statement by the ENACE [Argentine Nuclear Enterprise for Electrical Power Plants] trade union and stated that in January, renegotiations of the contracts for the construction of the Atucha II nuclear power plant, which "will be operating in 1992," will be concluded.

In statements to NOTICIAS ARGENTINAS, Constantini said CNEA's 1986 budget, including works in progress and CNEA's external debt, will be between $500 and $600 million. He said that this year "there will be enough funds to reactivate the Atucha II project."

Thus, Constantini countered a statement by the ENACE trade union that nuclear development in the country "is on the brink of collapse" and that CNEA's manpower is being "thrown overboard." Constantini denied that Argentine nuclear development "is on the brink of collapse" and said atomic activities for peaceful uses "are maintaining the same growth rate of recent years. Not only have we preserved CNEA's full scientific-technological development, but we have also preserved its manpower despite the shortage of funds," Constantini added. He reasserted that "there is no flight of CNEA scientists" and commented that "this is proven by the activity in the library, the scholarships to foreign countries, and the support given to the laboratories."

Assessing his nearly 2-year tenure as CNEA chairman, Constantini said: "We have increased all the activities for the application of nuclear energy for peaceful uses, especially in the field of nuclear medicine, and we have made contributions in other fields such as agriculture, industry, and power supply."

Constantini said that "in the field of nuclear power plants, ENACE workers know very well that the nearly 60-month delay of the projects originated 4 or 5 years ago and not when the current government assumed office." Constantini reiterated that President Raul Alfonsin "has made a political decision to complete Atucha II in 1992" and stated that this month, when the renegotiations of the contracts for that nuclear power plant are concluded, "we will stop paying the huge nonproductive expenses" resulting from the halting of the projects.

"All nuclear projects throughout the world had similar delays," Constantini added. "Not only we have preserved the manpower, but we have also improved in the field of radioisotopes and resumed a normal pace in the technological development of nuclear power plants," Constantini concluded.

/9274
CSO: 5100/2034

BRAZIL

ANGRA 1 NUCLEAR PLANT SHUTS DOWN FOR MAINTENANCE

PY072139 Sao Paulo FOLHA DE SAO PAULO in Portuguese 5 Jan 86 p 32

[Text] Rio--The Angra 1 nuclear plant, located 197 km south of Rio, was shut down yesterday for its first change of fuel and a general checkup. The plant will reopen during the latter half of May. Because of the shutdown, the southeast region will lose an average of 375.6 megawatts of electrical energy an hour. This will add an additional burden to that already overloaded electrical sector which has suffered two black-outs this year.

Evaldo de Oliveira, 44, superintendent for technical support of Furnas Electric Company, has said that every nuclear plant operating at full capacity has to change a third of its fuel after 10 months of operation. He added that a plant which is operating at a smaller capacity can do so after 15 months, at most. The Angra 1 plant has been operating commercially since January, therefore this first checkup will take place 12 months after it joined the southeast electrical system.

In the opinion of the Furnas director, the Angra 1 plant has been operating at full capacity (626 megawatts/hour) since September 1984, when the operational tests started, although it only began operating commercially in January. It generated 3.113 million megawatts of electricity from 1 January to 30 November 1985, and "will end the year having generated 5 million megawatts. This means it will have operated at an average of 60 percent of its working capacity, which is above the operational average of U.S. plants."

The Furnas superintendent said that the price which Nuclebras will charge Furnas for nuclear fuel is still being discussed. However, the company knows that it will spend $15 million (155.6 billion cruzeiros at today's dollar rate), to change the 48,000 pipes of the reactor's steam condenser vessel.

Oliveira said that when the nuclear reactor of the Angra 1 plant was bought from Westinghouse, it used a chemical treatment in the steam generator which caused corrosion problems. In 1979, Furnas decided to use a different chemical treatment. However, after the reactor was started, the company detected problems caused by barnacles (crustaceans that gather around the condenser tubes), which bore holes in the copper

and nickel tubes. These tubes will now be replaced with others built out of titanium. Furnas will take advantage of the shutdown to make the first general examination of the equipment and to replace some parts (pumps, water system, cathodic protection of the tubes, etc). In addition, the company will implement security measures for the operation of the reactor, taking into account the measures that were internationally adopted after the accident in the U.S. Three Mile Island plant.

Furnas will also make a general inspection of the equipment, particularly the turbine and the generator, for which the Westinghouse guarantee period has not yet expired, to check for any abnormal wear. The generator tubes will undergo a series of tests.

/12858
CSO: 5100/2033

BRAZIL

NUCLEAR PLANT CONSTRUCTION ENCOUNTERING OBSTACLES

PY232125 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 20 Dec 85 p 29

[Text] Rio de Janeiro--Licinio Seabra, president of the Brazilian Nuclear Corporations, Inc. (Nuclebras) said yesterday that Nuclebras lacks $1.8 billion to finish the Angra-II and Angra-III nuclear plants. This amount will have to be spent between now and 1995, when the two units will be ready. They will have cost the country $7.5 billion--$3.5 billion in direct costs and $4 billion in financial charges.

According to Licinio Seabra, the operational budget approved by the Special Secretariat for the Control of the State-owned Enterprises [Secretaria Especail de Controle das Empresas Estatais--SEST] for next year is hardly enough for the first two quarters, because Nuclebras requested 7.7 trillion cruzeiros and the SEST approved only 3.5 trillion. The total nuclebras budget is 23.4 trillion cruzeros, 67 percent of which, i.e., 15.6 trillion, is earmarked for paying the interest on foreign and domestic debts. Nuclebras is 200 billion cruzeiros behind in its payments to contractors and suppliers.

Since the SEST did not provide the necessary resources for Nuclebras to carry out the minimum work of its 1986 project, a special work group has been formed with experts from the finance, planning, and mines and energy ministries and from Nuclebras and Eletrobras [Brazilian Electric Power Companies, Inc.] to outline before April a recovery program for the nuclear sector.

According to Nuclebras' president, this group of experts will have to outline a milti-year budget for the Angra-II and Angra-III projects.

/9274
CSO: 5100/2031

INDIA

GANDHI INAUGURATES REACTOR, PROMISES PEACEFUL USE

NC161027 Paris AFP in English 2005 GMT 16 Dec 85

[Excerpts] Madras, India, Dec 16 (AFP) — Prime Minister Rajiv Gandhi, speaking at the inauguration of a new 50-megawatt fast-breeder test reactor — the first ever built in the developing world — renewed his promise that India would use atomic energy only for peaceful purposes.

The plant, at Kalpakkam near here, is considered a landmark in India's nuclear development and is the first in the world using a mixture of plutonium carbide and natural uranium.

At ceremonies at the plant, attended by a large number of Indian scientists and several foreign experts, Mr. Gandhi said that the splitting of the atom "opened a new vista for harnessing energy that could be used for human welfare, but not for destruction." He stressed that India was fully committed to the cause of nuclear disarmament.

The reactor will speed up implementation of India's nuclear programme, aimed at providing at least 10 per cent of the country's energy generation by the year 2000, he said.

A total of 22 nuclear reactors are scheduled to be built over the next 15 years.

Mr. Gandhi christened the new complex the Indira Gandhi Centre for Atomic Research, after his mother and India's preceding premier, who was slain by bodyguards last year.

Georges Vendryes, advisor to the French Atomic Energy Commission, who was among the guests, said the new fuel held great promise for nuclear power generation.

"India could be world leaders in this fuel development and France is very much interested in the results of the fast reactor at Kalpakkam," he said.

C.V. Sundaram, the centre's director, said the sodium-cooled, loop-type facility was being operated at low power at present in order to measure the reaction of the core to the new carbide fuel.

The data could be used to enhance designs for fast-breeders, he said, explaining that a commercial fast-breeder reactor can generate power at competitive prices only if the maximum possible energy is extracted from its fuel rods.

Dr. Hans Blix, director-general of the vienna-based IAEA, said the launching of the Kalpakkam centre was a milestone in the development of nuclear science and technology.

"Its significance extends far beyond the frontiers of India. It is a truly remarkable achievement and shows what can be accomplished by a developing country in the nuclear sphere when the determination and dedication is there," he said.

Nuclear power and nuclear science were no longer the monopoly of affluent, developed countries, he declared.

/9274
CSO: 5150/0042

INDIA

URANIUM SMUGGLING VIA BIHAR-NEPAL BORDER ALLEGED

Calcutta RAVIVAR in Hindi 17-23 Nov 85 pp 16-17

/Article by Harivansh: "Uranium Smuggling to China and Pakistan From Bihar"/

/Text/ The Nepal-Bihar border is notorious for the smuggling activities carried out there. Bihar's political leaders always manage to appoint police officers of their choice in the border areas. They want to make sure that the business of smuggling is not disrupted. Families of high-ranking government officers and politicians travel to Nepal in their private cars and return with their shopping without paying any customs duty. International smuggling led by the "Godfathers" with important government positions in Patna and New Delhi is very active in this area. Recently some people trying to smuggle uranium were caught redhanded. Attempts are being made to hush-hush this case.

Mr R. K. Rai, in charge of Farbisganj police station, and Ramdev Tiwari, customs inspector at Anchal, were secretly informed on 15 July that some uranium was to be smuggled out via Jogvani. It is sold at a very high price to foreign smugglers in Nepal, and from there it is sent to Pakistan and China. According to this information a switch was being made on the evening of 7 July in Matiari Village. On receiving this information, both officers contacted the head office in Purnia and requested weapons and men for a raid.

Matiari is situated on the road going from Farbisganj to Nepal via Jogvani. There is an old garden about 300 yards east of this village. According to the information received by the police, the smugglers were going to make a switch in this garden. Several policemen under the leadership of R. K. Rai hid in that garden. They had hidden the police jeep also. Around 1900 pm two men arrived on a Bullet motorcycle from the direction of Farobisganj. After a few minutes a jeep arrived from the same direction. Two men got out of the jeep which continued toward Jogvani. A little while later, an Ambassador car arrived from Jogvani and was parked facing the direction it came from. The police became suspicious by the talk and activities of these people and surrounded them. Some of the suspects managed to run away, but three of them were arrested. According to the inspector from Purnia, about 5 kg of uranium in a polyethlene bag was recovered from the arrested persons.

The arrested persons gave their names as Kartik Virami, Sunil Kumar and Khagendera Singh. On interrogation Sunil Kumar admitted that the uranium was

stolen from the mines in Jadugora in Singhbhoom District. He added that uranium was smuggled to Pakistan via Nepal. A motorcycle (Tag number WGS 3957) was also recovered from this raid, but some men managed to escape in the car. They were identified as Rajendar Chowdhary, Ganga Chowdhary and Anil Chowdhary.

Interrogations of the arrested persons revealed that these three men were to give the bag of uranium to Durga Prasad Shah, owner of Tata Sweet Shop in Viratnagar (Nepal). The latter is supposed to have connections with foreign agents.

The police collected more information about the arrested men. It was learned that local people had been aware of Durga Prasad Shah's smuggling activities for a long time. The arrested three men were dealing with Durga Prasad. Ganga Chowdhary and Sunil Kumar went to Rajendar Chowdhary's home where uranium was stashed. They all worked out a plan for the switch. /When the plan failed/ Durga Prasad had made his escape with the money.

The police contacted the local customs officers and the head office in Patna and requested an immediate inquiry into this very serious situation. They also requested analysis of the recovered uranium by experts.

Investigations with the cooperation of Begusarai police revealed that Rajendar Chowdhary was a close associate of the infamous Begusarai smuggler, Kamdev Singh. Kamdev Singh was under the protection of some ministers and had terrorized the whole province of Uttar Pradesh. He was killed in a skirmish with the police a few years ago. The local customs officers revealed that they were also informed that Durga Prasad Shah, owner of Tata Sweet Shop, Viratnagar (Nepal), was associated with smuggling.

The security officer in Purnia made this entry in register number 2654 CR on 31 July 1985, "The evidence received indicates that Rajendar Chowdhary is the most important character in this drama. It has been learned that he was a close associate of the notorious smuggler Kamdev Singh."

In his conclusion, the investigating officer said that "they had conspired with the local officials of Jadugora mines to smuggle the expensive uranium for making money. Their action was against the interests of our own nation. They were planning to send uranium to China and Pakistan via Nepal. They were unsuccessful in their effort when the local officials got wind of their operation and were arrested while trying to smuggle uranium."

The investigating officer requested immediately arresting and taking strict action against the absconding culprits. He had also requested analysis of the confiscated uranium by nuclear scientists. He also wrote to the headquarters asking for an immediate investigation by the local police of the Jadugora uranium mines.

The investigating officer concluded in his report that this involved an international gang and that the security of India was involved. He requested an immediate inquiry by the CBI /Central Bureau of Investigations/.

On 1 July 1985, the assistant inspector general of the Criminal Investigations Division at Patna took over this case as per his memorandum 915 NGO, dated 25 July 1985. According to our sources, the assistant inspector general appointed Inspector Motichander Ram to investigate this case. "This case was closed in August 1985," Mr Ajit Sarkar said.

According to government sources, these smugglers have high contacts. When uranium was confiscated in that raid, the bosses of these smugglers became very active. They were trying their best to have the case dropped without full investigation.

This is a serious affair. It is connected with national security. The investigating officer of Purnia had requested involvement of the CBI and analysis of the confiscated evidence by experts. He had also asked for the investigation of some Jadugora persons who were involved in smuggling. Instead, this case was dropped on recommendations by a petty officer (who is much junior to the investigating officer). Is this action logical? Can a police officer decide if the recovered material was uranium or not?

Ajit Sarkar, a very vocal member (CPM) of the Bihar Legislative Assembly wants to shake the whole country on this very serious issue. He believes that leaders and high officials have started to stake the country's security in their wheelings and dealings. According to Mr Sarkar: "...Such actions demoralize honest police officers. The arresting policemen and officers were recommended for decoration by the investigating officer. What will these policemen think when they see the case being dropped because of political pressure?"

7997/12228
CSO: 5100/4726

INDIA

INDIA'S NUCLEAR POWER DEVELOPMENT POLICY DISCUSSED

Hanoi NHAN DAN in Vietnamese 25 Nov 85 p 3

[Article by Professor Nguyen Dinh Tu, director, National Atomic Energy Institute: "On the Occasion of Premier Rajiv Gandhi's Forthcoming Visit to Vietnam -- India's Nuclear Power Development Policy"]

[Text] In a speech at the 29th session of the International Atomic Energy Agency (IAEA) General Assembly held in September 1985 in Vienna, the capital of Austria, Dr R. Ramanna, chairman of the Indian Atomic Energy Commission, said, "The 1984-1985 period was a year of great success for the atomic energy program of India. Two new reactors were put into operation. An experimental reactor, with output of 100 megawatts (Footnote 1) (1 megawatt = 1 million watts = 1,000 kw.), uses natural uranium and heavy water (Footnote 2) (Heavy water is water in which hydrogen atoms have been replaced by deuterium atoms. It has the characteristic of absorbing neutrons very slightly) and was put into operation on 8 August 1985. The late Prime Minister Indira Gandhi named it 'DHRUVA,' an ancient word meaning 'North Pole Star.' Another important achievement was the fact that the second reactor of the nuclear power plant at Kalpakkam, near the City of Madras, was completed on 12 August 1985 and connected to the power network."

With the great vision of its leaders and the talent of its scientists of world renown, India had seen very early the extremely important role of atomic energy. Back in 1948, the prime minister of India presented to the National Assembly an atomic energy bill and the Indian Atomic Energy Commission (IAEC) was established. Then an Atomic Energy Office was set up under the direct supervision of the prime minister (presently the prime minister still is in charge of this office).

The goals of India's atomic energy program are nuclear power and applications to industry, agriculture, public health and scientific research.

Why did India consider nuclear power the top goal of its atomic energy program? That was because of India's actual fuel and energy resources. Its potential hydroelectric power capacity is 75 million kilowatts, with actual production capacity being 30-40 million kilowatts; if this figure is to be exceeded, construction will be very difficult and create many complicated ecological problems. About coal, the estimated deposits are more than 100 billion tons, with annual production currently being about 100 million tons and probably reaching 500 million tons by the year 2000. The production of thermoelectric power using coal presently reaches a total of 30 million kilowatts and is expected to reach 50 million kilowatts by the end of this century. A major weakness is the fact that in the mines coal distribution is irregular and the ash content is large (over 20 percent in many cases). Due to large extraction and transportation costs, electricity produced from the use of coal will be very expensive for the areas far from the mines. Other forms of energy (solar, wind, biological gas, geothermal) are either scattered or not yet developed to the point of being exploited on a large scale. In the meantime, India's electric power needs become larger and larger. While its total capacity presently is 40 million kilowatts, the projected need for the year 2000 will be 100-120 million kilowatts. About oil and gas, although India has increased the rate of extraction on its continental shelf, its production still cannot satisfy the current need and India must still import additional quantities of oil and gas. The production costs of electric power of oil-using plants are higher than those of coal-using plants.

That was why India had to think of the nuclear power solution. That was also the trend in the world and the conditions of India's resources also allowed the selection of this solution. However, since there are many ways to develop nuclear power, what would be the way to be selected? As the choice had to be made in the 1950's, when the world nuclear power industry was in its early stage, it was not an easy one. But with its talent and brain power, India succeeded in selecting a really correct nuclear power development strategy (and in general nuclear energy strategy), which has been proved the best for its conditions. The first basis was the nuclear fuel deposits. Surveys showed India has not very large deposits of uranium (U) ore and the U content in the ore is not very large in general. The deposits in the form of U oxide are about 73,000 tons, but the economic exploiting capacity is only about more than 49,000 tons of U oxide. On the other hand, the thorium (Th) ore deposits are very large, among the largest in the world, by estimate more than 360,000 tons. With such resources and with the capabilities of its industry, what nuclear power development strategy India would choose for itself? At that time there were three types of nuclear reactors it could choose for power production. One was the type of nuclear reactor using enriched U (Footnote 3) (Enriched U is U in which the isotope 235 exists in larger percentage than that of the same isotope in natural U, which is 0.72 percent) and plain water as moderator. From a purely economic standpoint, this type would be the best, but

the production of enriched U, which must be used, requires very complex technology and only a few countries in the world can produce it. Second, the type of reactors using natural U and the moderator is graphite. From the standpoint of being self-sufficient, for India this type of reactor would be acceptable, but actual calculations pointed to the fact that investment expenses would be too great. Third, the type of reactors using natural U and the moderator is heavy water. This type of reactors uses U in the most effective manner and also produces a new nuclear fuel, plutonium (Pu), in the largest quantity. For a country that does not have very large U deposits like India, which also wants to avoid having to produce enriched U, to choose this type of reactors would be the most appropriate move. Naturally, with this type of reactors to master the technology needed would be far from simple; in addition, India would have to know how to produce a large quantity of heavy water to be used in such reactors. India chose this road.

At the same time, its scientists adopted a long-term nuclear power development strategy consisting of three stages. Stage 1: To use the type of neutron heat reactors with natural U and heavy water (called PHWR for short). This type of reactors produces both electricity and Pu for the next stage from natural U and weakened U (Pu is produced by neutron action). Stage 2: To build the type of fast neutron reactors (also called breeder reactors) operating with Pu, produced by the type of reactors in the earlier stage, and due to its nature, producing even more Pu (from weakened U) or a type of new nuclear fuel, uranium 233 (from Th, by neutron action). Stage 3: To build the type of fast breeder reactors operating with U 233 (produced in stage 2) and from Th producing even more U 233, in a closed cycle and on an increasing scale.

Since India has large quantities of Th, by the time it reaches stage 3, its ability to develop nuclear power will be very great.

As early as in 1979, India already approved a plan that calls for producing by the year 2000 10 million kilowatts of nuclear power of the PHWR type (except the first nuclear power plant bought from the United States, operating with enriched U and being put into operation in 1969). These reactors will produce each year about 3,200 kilograms of Pu, enough to build in the first decade of the 21st century additional fast neutron reactors(breeder reactors) to generate 1 million kilowatts. With the quantities of Pu produced by the breeder reactors, in the last half of the 21st century there will be enough fuels to produce 350 million kilowatts of nuclear power. And when all of its Th is used, the total output will be even much higher.

As early as in the 1950's, India gradually proceeded with totally following that strategy: to build nuclear reactor and technology research facilities, to train science and technology cadres, to look for and explore radioactive ores, to

process U and Th into fuels for reactors, to do research on designing and making fast neutron reactors and to build them, to recycle the spent fuel rods to recover Pu or U 233, to treat radioactive waste, and so on.

The first major nuclear science center was built in Trombay (near the City of Bombay). It was there that India's first reactor was put into operation in 1956. And it was near this reactor that Dr R. Ramanna shook hands with President Ho Chi Minh at the time of the latter's visit, a fact that Dr Ramanna warmly recounted to Chairman Pham Van Dong and his Vietnamese colleagues when he visited Vietnam at the end of April 1985. Since 1967, the center has been named after India's well-known scientist, Dr H. Bhabha, the first chairman of the Indian Atomic Energy Commission, as the Bhabha Atomic Research Center (BARC for short). Presently it is one of the largest nuclear centers in the world, with more than 15,000 cadres, including 3,730 scientific cadres, and more than 7,000 technical cadres. It has five reactors (including the above-mentioned 100-megavolt DHRUVA reactor, which was totally built by India and put into operation on 8 August 1985). It was here that the first experimental reactors using Pu and U 233 were built (PURNIMA-1, later PURNIMA-2). PURNIMA-2, which began to operate on 10 May 1984, is the only experimental reactor in the world using U 233 and using the smallest amount possible of U 233 -- 440 grams. That is the greatest achievement of India's nuclear technology sector, which is moving toward using Th in the future. Almost all nuclear scientific and technical questions are tackled in research work at BARC and later are developed in research and production installations elsewhere in India.

The construction of nuclear power plants has reflected India's very wise and correct policy toward importing and mastering the very complex and advanced technology that is nuclear technology.

While India was actively preparing for building nuclear power plants using reactors of the natural U-heavy water type, it imported the first two reactors for the nuclear power plant in Tarapur (in Maharashtra State), the type of U.S.-made reactors operating with enriched U that was then considered relatively perfect. The purpose was to bring nuclear power into India early and to let its science and technology cadres have an early experience in building and operating a nuclear power plant under Indian conditions. The plant became operative in 1969 and encountered many technical difficulties in its first year of operation. Then, with improvement on the part of Indian technicians, the plant was in a better shape. But later it had to face some difficulties that had arisen from a U.S. refusal to continue supplying enriched U; and India had to do research by itself on replacing it with Pu recovered from the spent fuel rods.

By the time India had a second nuclear power plant, it had firmly decided to use the PHWR natural U-heavy water type of reactors. This second nuclear power plant was built in Rajasthan State and consists of two PHWR's of 220-megawatt capacity each. The first one was built with the cooperation of Canada, with planning and equipment coming mainly from Canada and with negligible participation by India. It was put into operation in 1972 and in the first years of operation at low output level, there were many breakdowns, mostly water leaks in the radiation detection component in the 1981-1982 period.

The second reactor was mainly produced by India, with its own equipment and with considerable contributions from Indian industry. It was put into operation in 1981, and right in the first year of operation, it worked better than the first reactor. That was a great progress in India's efforts to master the nuclear power technology in connection with the use of PHWR's.

However, not until the construction of the third nuclear power plant in Kalpakkam, near the City of Madras, did India fully master the technology. This plant also has two PHWR-type reactors, each having a 235-megawatt capacity. Many improvements had been put into its planning and almost all materials and equipment had been produced by India. The first reactor was put into operation in July 1983, and since then India has been considered the seventh country in the world having totally by itself planned, manufactured, built, started and operated a nuclear power plant. And finally on 12 August 1985, the second reactor was also put into operation.

Thus India so far has 3 nuclear power plants, with 6 reactors operating at a total output of 1.3 million kilowatts. Two other nuclear power plants, each having 2 PHWR-type reactors of 235-megawatt capacity, are being built in Narora (in Uttar Pradesh State) and Karhapa (in Gujarat State).

In order to carry out its program of producing 10 million kilowatts of nuclear power by the year 2000, India must continue to build 12 PHWR's, with capacity of 235 megawatts each, and 10 reactors of 500-megawatt capacity each. The sites for them have been or are being selected, with the conditions for ensuring fulfillment of this program being already set.

With 37,000 tons of U oxide enough to produce 10 million kilowatts of nuclear power in 25 years, India needs only to expand its mines and ore-refining plants in order to produce 1,800 tons of U oxide a year by the end of this century. The necessary quantity of heavy water is 13,000 tons; presently, India has been building 5 plants to produce heavy water and needs to build 4 large plants in order to reach the producing capacity of 1,530 tons of heavy water per year by the end of the century.

The installations that produce fuel rods and the plants that reprocess fuel rods must all be expanded. Industries must be mobilized for manufacturing the equipment necessary for construction of nuclear power plants; as a result of this, such sectors as engineering, metallurgy, electronics, and so on will move to a higher degree of development. To have enough cadres for the program aimed at production of 10 million kilowatts of nuclear power requires the training of 6,000 additional scientific cadres and 29,000 more technical workers.

From the economic standpoint, by the 1983 calculations, the cost of nuclear power was 6.4 percent cheaper than the cost of electricity produced by a coal-using power plant of the same capacity located right next to a coal mine; if this coal-using power plant were located at a distance of 800 kilometers from a coal mine, the cost of nuclear power would be 24.5 percent cheaper.

From the standpoint of safety, the experience in operating the nuclear power plants showed that the increase of radiation level was negligible (only about 1 percent of the natural radiation background). We should add that coal also contains radiation, though very little, but since the coal-using power plants must use very large quantities of coal, they emit a level of radiation 4 times higher than that emitted by nuclear power plants of the same capacity.

The picture will not be complete if we do not mention India's great achievements aimed at preparing for the later stages of its nuclear power program. In order to do research on fast neutron breeder reactors, India has built the Reactor Research Center (RRC) in Kalpakkam. There, a fast neutron breeder reactor of 40-megawatt capacity (FBTR) using carbide compound with Pu-u as fuel and Na and molten metals as heat carrier is being built for operation to start at the end of 1985. When this reactor is completed, India will rank itself among the most advanced nations in this extremely complex technical field. At the same time, while the construction of this 40-megawatt reactor goes on, Indian science and technology cadres have also started planning for another fast neutron breeder reactor to be used in a nuclear power plant of 500-megawatt capacity.

Along with mastering the fission technology, India has also done research on other fields of advanced science, such as controlled thermonuclear reaction, including the method of using high-power laser to create thermonuclear reaction, high-energy accelerator, and so on. With this goal, a research facility called Advanced Technology Center (CAT) has been built in Indore, in the central part of India.

Along with the Soviet Union, India is a model of the policy of using atomic energy for peaceful purposes. With a creative policy of self-reliance and self-

strengthening, in more than 3 decades India has made brilliant achievements. We wish the nuclear scientists of India good success in making new achievements and attaining their noble goal of using atomic energy for peace and for a happy life of man.

5598
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INDIA

OFFICIAL DISCUSSES PROGRESS IN NUCLEAR POWER

Bombay THE TIMES OF INDIA in English 25 Nov 85 p 1

[Text]

BARODA, November 24 (PTI).

TARAPUR is one of the sites being considered for setting up a 500 MW atomic power station, the Nuclear Power Board (NPB)chairman, Dr. M. R. Srinivasan, said today.

Designing of the proposed nuclear unit likely to be commissioned by 1995, had made a good progress and the Centre's decision on the site was being awaited, Dr. Srinivasan told reporters here.

The country had made a substantial progress in designing and mechanised contruction techniques for nuclear power station erection and soon it would be possible to build an atomic unit in seven year's time, as against eight years at present, he said.

The nuclear power units were "quite safe" for generation of large quantities of power and the government was encouraging manufacture of components and instruments for atomic stations, Dr. Srinivasan said. At least 90 per cent of components at the Kalpakkam station near Madras were made indigenously, he said.

Advocating use of nuclear power, he said atomic energy would come in handy particularly at a time when the prices of conventional energy sources like coal and petroleum gas were rising.

India must expand its nuclear power base for all round economic growth, he said adding that for this adequate financial resources should be sanctioned at the earliest.

UPCOMING PROJECTS

Giving details of upcoming projects, he said erection of two units of 235 MW each was on at Kaiga in Karwar region of Karnataka. Work on nuclear units was also apace at Narora in Uttar Pradesh and Kakrapar in South Gujarat, he said.

UNI adds: According to Dr. Srinivasan, once industrial capacity was built up for a programme of 10,000 MW, a stage of maturity would be reached which would permit a more rapid acceleration of nuclear power capacity.

For this, it was necessary not only to accelerate the present programme of building reactors based on heavy water and natural uranium, but also build fast breeder reactors and eventually utilise the "virtually inexhaustible" energy resource available in thorium, he said.

Estimates of the energy potential show that the uranium resources available in the country can support a programme of 350,000 MW when they are fully utilised by fast reactor and possibly a million MW when the country is able to exploit thorium, he said.

The industry is now at a stage when it can make the high quality components in short periods. Therefore, what is now required is a commitment of adequate resources so that work could commence on a number of projects at the same time and batch orders of equipment be given, he said.

At the same time, the board has standardised designs and proposes to use mechanised techniques of construction so that the time taken to build a nuclear power station comes down from eight to seven years, he said.

About safety, he said the radiation risks from nuclear stations were less than those from many other normal activities.

A nuclear power plant does not produce any significant quantity of radioactive waste, Dr. Srinivasan said.

The technique available today is for this waste to be substantially reduced in volume and vitrified into a glass matrix of small volume.

The vitrified waste is encapsulated in stainless steel and buried underground for long-term storage, he said.

The quantity of waste from a 1,000 MW nuclear power station operated for one year is only three cubic metres, he added.

/9317
CSO: 5150/0040

INDIA

PLANS FOR CONSTRUCTION OF NUCLEAR REACTORS TOLD

Bombay THE TIMES OF INDIA in English 18 Nov 85 p 5

[Text]

BOMBAY, November 17 (PTI): The Department of Atomic Energy (DAE) proposes to start work on a maximum of eight power reactors of 235 MWE capacity and six units of 500 MWE capacity during the seventh five-year plan, according to highly-placed sources.

This would include the already announced two units at Kota in Rajasthan and two units at Kaiga in Karnataka (all 235 MWE capacity) the sources said.

The sites for the remaining reactors are yet to be finalised, though the site selection committee of the DAE had submitted a detailed report on this to the Union government last year itself.

However, the DAE is reportedly planning for large-scale expansion of the Tarapur Atomic Power Station and the country's first two 500 MWE nuclear power reactors are likely to be located there, the sources said.

The Centre has sanctioned Rs. 1,400 crores for the nuclear power sector during the seventh plan, though the DAE had asked for Rs. 2,600 crores. "We are expecting more money during the mid-term review," the sources said.

The DAE authorities are yet to finalise whether to invest the sanctioned money in a few reactors and try to complete them fast or to "spread it across". However, the Prime Minister, Mr. Rajiv Gandhi, had said the seventh plan would give more emphasis on the hydro-electric sector, as "we want to start power generation immediately".

At the end of the seventh plan, the DAE would be able to add only the two 235-MWE reactors at Narora in U.P. to the nation's power generation capacity. Even the two Kakrapar units, work on which has already started, would begin to function only by 1991.

The DAE's ambitious plan is to achieve 10,000 MWE nuclear power capacity by 2000 A.D. and the 'profile' for this has already been approved by the Central cabinet.

/9317
CSO: 5150/0037

INDIA

BJP LEADER TELLS PARTY STAND ON NUCLEAR DEVELOPMENT

Bombay THE TIMES OF INDIA in English 18 Nov 85 p 7

[Text] Warangal, November 17 (PTI)--India should make an atomb bomb and the Prime Minister should declare it openly, instead of "dilly-dallying" on the issue so that it might deter Pakistan from going nuclear, according to the Bharatiya Janata Party (BJP) president, Mr Atal Behari Vajpayee.

"The Centre has to take a clearcut stand as its pronouncements about a nuclear threat from Pakistan were creating confusion within the country," he told a press conference here today.

Asked how an open declaration by the Prime Minister would help the country, he said ours is a democratic nation unlike Pakistan and the people have the right to know whether such an option is desirable.

Mr Vajpayee stressed that "too much dependence" on any superpower was not in the interest of the country and regretted that the Centre was "slowly giving up" the goal of self-reliance and following a policy of "double dependence" for high technology on U.S.A. and for arms on the U.S.S.R.

Referring to India's relations with the Soviet Union, he said co-operation was a must and the friendship should also be strengthened but he felt "we are depending too much."

Asked what was the alternative when America was pumping sophisticated weapons into Pakistan, he said "The Prime Minister should have converted Mr Reagan."

It was unfortunate that the Indian doors have been left wide open for multi-nationals, who are only interested in profits and not in the country's development, he said.

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CSO: 5150/0039

INDIA

JANATA OFFICIAL GIVES POSITION ON N-WEAPONS

New Delhi PATRIOT in English 30 Oct 85 p 5

[Text] Senior Janata Party leader and member of the national executive Krishan Kant has taken strong objection to party general secretary George Fernandes' stand on India's nuclear options and said that Mr Fernandes did not represent the party's position on the issue.

In a strongly worded statement issued in New Delhi on Tuesday, Mr Krishan Kant said that the "advice" of US President Ronald Reagan to Prime Minister Rajiv Gandhi about the Pakistani progress on the nuclear weapon should have opened the eyes of all patriotic people and that there could now could be "no dilly dallying and weak hearted moral objections to India going nuclear."

"George seems to be a conscientious objector to nuclear violence," Mr Krishan Kant said and added that his (George's) stand "logically leads to a position where he would consider it morally correct to throw Indian armed forces into the battlefield against a nuclear adversary and want them to offer civil resistance when we do not have a comparable weapon by a conscious decision."

"This cannot be the position of a responsible political party which is fighting back to power," Mr Krishan Kant said. The Janata Party recalled the Bangalore resolution of the Janata Party on the nuclear question adopted "in spite of the opposition of Mr Morarji Desai" in June 1981 which had stated that India will have to go nuclear if Pakistan goes nuclear.

In fact, Mr Krishan Kant added, the Ballia resolution had gone a step further by stating that India had a right to exercise its nuclear option in full freedom making it clear that India was not circumscribed by Pakistan but by all possible adversaries including China. The position was explained to Mr Fernandes in Ballia, Mr Krishan Kant said, but obviously he had refused to accept the position.

This is not the first time that Mr George Fernandes' stand on an issue has been clarified as not being the party's official position. A few months back Mr Fernandes had given a call for the boycott of all meetings convened by the Government in protest against Mr Rajiv Gandhi having described some

leaders as "traitors" during the election campaign. Party leaders had hurriedly pointed out then that Mr Fernandes had given the call in his individual capacity and leaders like Mr Madhu Dandavate had openly defied the call by participating in consultations by Mr Rajiv Gandhi to solve the Punjab and Assam problems.

/9317
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INDIA

BRIEFS

THORIUM FUEL TESTED--Experiments are being conducted at the Madras atomic power project--MAP--at Kalpakkam to determine the economic feasibility of thorium as a fuel for power reactors. A spokesman of the project told PTI in Madras that 60 kg thorium bundle loaded into the second unit of the MAP is likely to be taken out for irradiation tests some time in February or March next year. [Text] [Delhi Domestic Service in English 0240 GMT 8 Dec 85 BK] /9274

URANIUM IN KARNATAKA--Bangalore, Nov 17 (UNI)--Studies of galena found in the deepest mine in the world--the Champion reefs of Kolar goldfields in Karnataka--by an Indo-Soviet team have indicated the presence of an enriched uranium source in the vicinity of the mine. Dr G.V. Anantha Iyer, a geo-chemist of the Indian Institute of Science (ISSCO) here and a member of the group, said that mass spectrometry measurement of galena revealed the presence of unusually uranium-enriched lead isotopes. These radiogenic lead isotopes must have originated from an enriched uranium source located either in the mine or nearby. He said the studies were carried out in collaboration with Y. Safonov and Enkin and Chernyshev of the Academy of Sciences, USSR. The other Indian geologists were B. Krishna Rao, Department of Geology, Mysore University and V.N. Vasudev, Department of Mines and Geology, Karnataka Government. Dr Iyer said the discovery was made when the team was studying the genetic features of gold ore deposits at Kolar goldfields. [Text] [New Delhi PATRIOT in English 18 Nov 85 p 5] /9317

CSO: 5150/0038

ISRAEL

NUCLEAR RESEARCH PARK, ITS PRODUCTS DESCRIBED

Tel Aviv TEKHNOLOGIYOT in Hebrew Oct 85 pp 16-23

/Article: "Activities of the Nuclear Research Center in the Area of Industrial Applications--NRC--the Products That Come After"/

/Text/ In this article the public is presented for the first time in depth with the activities to develop high-tech industries. In an interview with "Tekhnologiyot" the heads of the Nuclear Research Center (NRC) survey the tremendous activity of the center in the area of industrial applications which serve as the basis for an industrial park to be built next to the NRC.

The NRC in the Negev is the center of the Atomic Energy Commission. It was built at the beginning of the sixties near Dimona. Many rumors spread about what was going on between the walls of the center and more than once it served as the central issue in books and articles written abroad about Israel's atomic capability.

In recent years a new type of activity has found expression in the activities at the NRC: moving toward the area of advanced industry. This phenomenon is familiar in nuclear research centers around the world. Everyone tries to exploit the advanced knowledge and the scientific achievements which have accumulated during the years of atomic research, to advance industry and to apply findings and developments in nonnuclear areas. The advantage of nuclear research centers lay in that they developed excellent think tanks whose applications in industry are not unique events or one time events, but rather a regular connection was created between research, development application and production, which repeats itself.

Director of the NRC, Avraham Sarusi, emphasizes that, "the NRC always had scientific and professional contacts. The fact is that many of our people were the first teachers and lecturers of Ben Gurion University. The NRC also has external contacts in the area of scientific and technological development, in the country and abroad. The center is also known from scientific publications of its scientists in professional journals."

The head of the division of Research and Development at the NRC, emphasizes that "nuclear technologies are most advanced. They rely on things which are at the edge of scientific and engineering knowledge in the world. Therefore dozens of learning centers rose around them."

The professional staff of the NRC numbers many with academic and technical degrees. The R&D in the center is carried out by its laboratories, which are laboratories for metallurgy, physics, chemistry, radio-chemistry, electronics, and analytic laboratories. Some of the development work is done in the central factories of the NRC which handle metal, electricity, and plastics.

"In the last 2 years we started to exploit all the knowledge centers possible in different directions," says Avraham Sarusi. "In one area we already have applied knowledge of the NRC in a factory for growing crystals, Kerem Optroniqa, which was established in Dimona. In another case production of uranium from phosphoric acid is applied by Rotam Fertilizer factory, next to the Arad conglomerate. There is also an intention to develop an industrial park near the Oron road, near the NRC. The goal is to centralize there a number of high-tech industries which will make possible development of the area, and will draw outside investors."

Sarusi sees a basic difference between the industries which will be built around the NRC and the high-tech industries elsewhere: "In commercial industry someone comes with an idea, it is applied and sold. Here we already have think tanks, which are able to contribute to industrial application. We have topics in which we are already beyond the R&D stage and some of which have even been applied. Some of the products, such as medical lasers, are already in advanced experiments in hospitals."

"A problem exists in Israel with those high-tech industries that are not actually based on such centers, that exploit a one-time unique idea," emphasizes the director of the NRC. "It is not certain that everyone will succeed in continuing development at the center. If competition comes from the United States, Japan or another country--the picture could change and we will be in a bad situation."

"We are taking topics in which we are experts on the technical side and trying to interest investors who could aid us on the commercial and marketing side," emphasizes Sarusi, "We have a number of ideas ready that we are trying to actualize. However I am not certain that we will succeed in all of them."

The director of the NRC sees in springing into the commercial-industrial market as well a level for increasing industrialization of the Negev. "In our opinion the capability which lies in the entire region, with technical schools and the university which are located in it, is enough for all the personnel required for development in the coming years. Today the people in the area do not have enough places of employment and they are leaving to go north. If we succeed in the coming years to turn this around it will be not only a commercial success but also will have a national dimension."

The Challenge is the Nuclear Power Station

Parallel with penetration of the industrial market and the establishment of factories directors of the NRC today are anticipating the era of the Nuclear Power Station in Israel. The assistant director of the NRC, Tzvi Katzni'el says, "Recently the newspapers have written about contacts made for the

establishment of nuclear power stations in Israel and we hope that this matter will indeed be actualized soon in Israel. For many years we have awaited this moment. Many studies which we carried out were directed to this goal. A base was created and a great deal of knowledge accumulated on topics concerned with nuclear power stations, and therefore it is accepted that the NRC will be involved and will contribute greatly in the establishment of future nuclear power stations in Israel."

NRC is in contact with the Center for Nuclear Research (CNR) at Nahal Soreq. This means contact at all levels--starting with coordination of management and down to the work level. There are projects in which work is clearly divided between the two centers, principally in areas in which there is an advantage to one of the two bodies. There are joint projects, which exploit the specific think tanks which developed over the years in each of the centers.

Rotam--The Commercial-Industrial Arm

To enable the penetration of the NRC into the industrial market the Rotam Corp was established, which in fact is the commercial arm of the NRC. Rotam is a government company under the authority of the Office of the Prime Minister.

There were three principle goals behind the establishment of Rotam:

--Establishment of factories based on the think tanks at the NRC.

--Raising of financing sources for R&D which will be done at the NRC for commercial applications.

--Licensing of know-how--sale of know-how or patents to existing factories if there is no need for establishment of a new factory.

"Rotam, as a government company, has made a principle of raising nongovernment money for establishing factories," says the managing director of the company, "Gid'on Shavit. "We seek partners who bring financing, with the NRC supplying the know-how. The ideal partner which we seek should have industrial experience, primarily marketing. We have great experience in R&D and ability in application, and we lack experience in the market."

Rotam's multiyear program includes a number of factories with an investment of about $10 million.

Shavit emphasizes, "It is the nature of things that the elements willing to make such investments are large economic bodies who have the ability to take chances. We are interested in such partners, who would be able to withstand difficulties."

The first factory already established, Kerem Optroniqa, in cooperation with Koor, is located in Dimona and has about 25 employees. The factory was established about a year ago and investments in it came to about $2 million.

Additional factories will be established in the industrial park, which will spread over about 200 dunams. At present two structures are being built in the park by a company for industrial structures: one structure for a future laser factory and the second structure, multipurpose, intended to accommodate smaller factories.

As was stated, in some cases the NRC, via Rotam, sells know-how to other factories. Thus, for example, the NRC recently cooperated with Amcor in development of a personal instrument for radiation detection. The know-how was sold to Amcor, which is producing and selling the device. Rotam earns royalties from this. Another example is a fire resistant material designed for safes. At present Rotam is involved in negotiations with one of the chemical factories in the area, on development of a certain chemical material.

From the Glove Box to the Incubator

As was stated, there are several subjects at the NRC which have reached readiness for industrial application. One subject is that of the glove box: work with radioactive materials or other dangerous materials requires protection of the workers from such materials. Therefore the work is performed within a glove box which is in a state of subpressure in comparison with the environment, with all treatment being done with gloves, or in cases of high radiation, with manipulators. Adapting a glove box to a factory requires understanding and a study of the production process in that factory, with the goal being to simplify as much as possible the process and to protect the health of the employee.

In the area of glove boxes much know-how and experience have been acquired at the NRC and for several years the center has been selling this know-how to industrial factors, laboratories and universities. At present the glove boxes are being produced--and a few have been supplied to factories in the country--in the NRC. The NRC wants to institutionalize the matter from the commercial aspect and to base it as a factory in the new industrial park.

Based on the knowledge accumulated on the subject of glove boxes the NRC developed, with the support of the chief scientist of the Ministry of Industry and Commerce, an incubator for premature babies. This incubator today is in Sha'arey Zedek Hospital and another will soon be installed at Beilinson Hospital. "We hope that the incubator will be one of the production lines of the new factory," says the chief of the R&D Division at the NRC.

Isotopes and Radioactive Sources

The oldest area of specialization of the NRC, which is ripe for industrial application, is that of isotopes, radioactive sources, and labelled molecules. "We offer these products to research institutions, universities, hospitals, and to agriculture," says the chief of the R&D Division. "Materials labelled with radioactive materials are used for monitoring processes or physiologies as well as for therapy. We operate this subject as a business unit which markets these materials in the country and abroad."

Managing director of the NRC, Avraham Sarusi, emphasizes that materials in the area of nuclear medicine are checked by the laboratory for nuclear radiobiology and by the laboratory for radiochemistry which executes the syntheses of the materials. The NRC manufactures the labelled molecules with tritium and also performs chemical treatment of materials such as iodine 125, iodine 131, and phorphorus, which are used for radiologic tests in hospitals. There is also a group specializing in organic syntheses with radioactive materials or anti-cancerous agents.

Production of Uranium from Phosphates

The Atomic Energy Commission has been performing experiments for about 30 years in an attempt to produce uranium from phosphates. Over the years about six different processes have been developed, two of which were found to be effective.

One installation for production of uranium, small in dimension and in its yield, was active at the end of the fifties and at the beginning of the sixties at Fertilizers and Chemicals Ltd. in Haifa. The factory was active for approximately a year and a half and was closed due to economic infeasbility: the quantities were small and the prices high.

Another process was developed and applied at the beginning of the seventies when the Arad conglomerate was established. The acid factory was intended to produce 160,000 tons of phosphoric acid per year, but reality struck the planners of the factory and today it produces 20,000 tons per year. "We developed a process which was specially adapted to the Arad conglomerate," says assistant director of the NRC, Tzvi Katzni'el, "since this was a unique process for producing phosphoric acid." The factory was established and during its trial period a few tons of uranium were produced. But when it became clear that the Arad conglomerate did not meet expectations the installation was closed. "The factory for phosphoric acid today stands as a white elephant," says Katzni'el. "The uranium factory exists but we don't produce since the quantities are quite small."

About 4 years ago in the area of the Arad conglomerate a factory was established for phosphoric acid which operates on a large scale using a classicial process called "the wet process." In this factory the NRC developed a new procedure for production of uranium. Tzvi Katzni'el says that this is "a unique process in the world with advantages over all existing processes today. We have received a patent from the United States and there is great interest in the new procedure."

All of the processes which existed until today were based on liquid/liquid extraction (solvent extraction). The NRC developed a process based on ion exchange. This procedure has many advantages from a technological and economic standpoint: the investment in a factory for producing uranium and cost of production of uranium is about half of that in the regular processes with the same capacity.

The NRC established a quasi-industrial installation for producing uranium using the new procedure, which is in operation near the Rotam Fertilizer acid

factory in the Arad conglomerate. In the future--depending upon budget and finance sources--the NRC is planning to establish a factory in the area for production of uranium. Today first contacts are being made with an industrial body in order to examine the establishment of a joint venture in this area.

Nuclear Materials and Equipment

An additional area which developed in the NRC is various materials disciplines. This topic developed as a result of the nature of the nuclear center, which requires a strong base in the subject of materials as a result of the hostile environment of nuclear reactors, radiation, high temperatures and the corrosion. According to the people at the NRC "the matter of materials is one of the subjects in which the NRC excels both in national and in world measurement. We are considered a most advanced laboratory in various topics in disciplines concerning materials."

In the NRC there is a unit for development of plasma coatings for metals. For example--titanium nitride coatings for tools. These coatings protect against corrosion and wear. NRC today is in contact with elements for applying its knowledge in this area. It is its intention to establish a unit (perhaps even a factory) which on the one hand will be able to supply coatings according to specification to those requesting them and on the other hand will be able to develop, to plan and to build installations to produce specific coatings for designated purposes. The estimate on this topic is that within a year it will be possible to achieve prototypes and in 2 years the subject will be ripe for establishment of a factory.

Also in the area of nuclear instrumentation a great deal of knowledge has been developed in the NRC, first as a consumer. "We are a careful consumer who knows to suggest special specifications and requests," says the chief of the R&D Division. "With the support of this knowledge and of the advanced electronic workshops here we recently entered into development of specific nuclear instrumentation. This instrumentation is said to be the basis for one of the factories in the industrial park, whose product will be sold abroad and in the country.

An additional area of specialization of the NRC is filtering and purifying gases and liquids--filtration in nuclear installations. At the NRC filtration based on membranes and fibers of carbon has been developed, which enables work at high temperatures in hostile environment. This area is covered by patents. One of the byproducts is an installation for purification of water for purposes of dialysis, whose development is financed by the chief scientist of the Ministry of Industry and Commerce. This installation will make possible the construction of a home dialysis system. Also being examined are development topics connected with purficiation of gases and their separation in hostile environments and at high temperatures.

Growing Crystals

The topic of growing crystals was developed at the NRC principally for purposes of producing detectors. In this area the NRC's capabilities ripened and the

Kerem Optroniqa factory has already been established. At this factory Sapir products are manufactured--heads for air-to-air missiles and various types of windows, such as windows for chemical processes. One of the advantages of Sapir is its transparency in the visible spectrum, in high temperatures, in hostile environment and its durability against wear. The Sapir can be used, among other things, as windows for chemical reactors and as windows for the periscopes of submarines. Another product is neodymium yag poles for lasers, with principal consumers of these products being laser factories in Israel and abroad.

The topic of crystals today is still at the beginning of its development. The intention is that the crystal unit at the NRC will continue developing other single-crystal products, which will be the next products of Kerem Optroniqa.

Lasers

A lot of knowledge has accumulated at the NRC in the area of lasers. "We want principally to apply two types of laser," says Tzvi Katzni'el. "One laser based on metal vapor and the second the advanced holmium-yag laser."

The first laser is based in principal on brass metal vapor and according to Katzni'el it has advantages over all lasers today existing in the world in the area of eye operations. An additional use of this laser is in the area of identification of fingerprints and in this matter the NRC is in contact with the Israel National Police.

Lasers based on brass vapor in the visible spectrum has greater achievement. They can transmit either a yellow or a green wave. These lasers are considered a future alternative to lasers based on argon.

The industrial prototype of the medical laser of the NRC is already in operation in Beilinson hospital where experiments on eye patients are being performed. This laser can also be used for plastic surgery, such as skin operations. Experiments in this direction have already been made and the final application stage is approaching. "We are in contact with a large economics firm in the country about establishing a factory," reveals Katzni'el. "Within 2 or 3 months, four industrial lasers will be produced which can be used as prototypes. It is possible that we will send one to a hospital or to a medical laboratory in the United States for clinical experiments, at this stage principally on animals."

Based on the metal vapor laser, with certain technological changes, it is possible to produce a laser based on gold metal vapor, a laboratory sample of which already has been developed at the NRC. This laser transmits a red wave at high performance. Due to the length of the wave when it is red, this wave is able to operate properly in interaction with chemicals for photodynamic therapy and it is thus efficient for use in treatment of cancer. By means of this system material which penetrates the cancerous cells is injected and with the next light wave from the laser the material falls apart and causes destruction of the cancerous cells.

The second laser, as was stated is the Ho-Yag laser, which stands for Holmium Ytrium Aluminium Garnet, which is active laser material in solid state in the shape of a crystal rod. When the holmium, which is a rare base, is exposed to bright light, it creates a laser beam in the near infrared part of the spectrum with a wavelength of 2.1 micrometers.

The Ho-Yag laser is expected to be one of the most useful in medicine. An operation using this laser stops the bleeding during the operation. It is also possible using the Ho-Yag laser to penetrate the body using optic fibers without cutting it. Development of this project, being carried out at the NRC, is being done with financing from the Ministry of Commerce and Industry and American investors. The heads of the NRC hope that by the end of the fiscal year the development will be completed. It should be emphasized that this type of laboratory laser is already in use at Beilinson hospital in animal experiments.

Application of the Moire Effect

An additional area of activity is applications of the Moire effect, in which optic fibers are used for mapping. "The Moire Effect has been known for many years already," says the chief of the R&D Division at the NRC, "but we were searching for methods for precise mapping of optic products." The first application of this effect, developed at the NRC, is being used in the wind tunnel of the IAI where a deflectometer of the NRC was installed to perform mapping of density differences. Three similar deflectometers are in the United States.

The NRC is planning in the near future to develop an instrument, based on this idea, for plastic surgery. The reason is that the Moire effect has an advantage when one wishes to map an organ of the body whose shape is not geometrically sophisticated. Based on knowledge accumulated at the NRC on the subject of the Moire effect the heads of the center hope to establish an industrial factory in the future.

Process Monitoring

Over the years expertise has been developed at the NRC in the area of Process Monitoring. In the meantime the NRC performs this as order are received. If it is proven that this area is financially justified, a special plant to deal with it will be established.

Assistant Director of the NRC, Tzvi Katzni'el, reveals that the center carries out the planning and installation of Process Monitoring in advanced, sophisticated factories in the southern area or that are planning to move to this area.

/Box on p 17: Deflectometer Based on the Moire Effect/

A deflectometer based on the Moire effect presents a new approach to nondestructive tests. Instead of measuring differences in optical paths, such as in the systems for measuring interference (the interferometric systems) the Moire deflectometer enables mapping of ray deflections, which are easily processed.

The Moire deflectometer can execute any measurement that can be performed by techniques for measuring interference or other techniques. The sensitivity of this deflectometer enables the user great variety of applications, starting with the examination of optic components at high quality and measurements at low sensitivity.

The deflectometer is able to simultaneously measure modulation transfer functions (MTF). Since the Moire deflectometer is based on geometric optics, precise knowledge of the phase, which is the base for the other type of measurement is not important. Thus the mechanic stability requirements of the system are determined by the sensitivity of the measurement, and not by the wavelength of light. This brings about insulation from shocks and shaking, which enables the Moire deflectometer to be used at the level of the factory and other noisy environments.

Applications include characterization of optical components such as windows, lenses, mirrors, prisms and laser parts; analysis of transparent methods, such as mapping temperatures of flames and visualization of flow; measurements in micrometers of geometric characteristics, static and dynamic.

/Photograph on p 19: glove box/

Glove box developed at the NRC serves as a hermetic cover which separates the material inside from the employee who is doing various things to the material, using gloves and internal equipment suited to the process. The hermetic insulation of the box enables the employee to function without any special protective means such as mask, special clothing, and so forth.

The box must be in a state of relative subpressure as compared with the environment in which it is located, and this is in order to prevent leakage--even the smallest amount whatsoever--of the material located in it to the external environment. Subpressure in the box is achieved by constant pumping from the box via a filter located by the suction vent. Air enters the box through an additional filter, near the incoming air vent. The subpressure in the box is determined with the aid of regulator cocks beside the filters. All of the glove boxes are examined according to the regulations of the Atomic Energy Commission. Permissable leakage: 0.05 percent of the volume of the box per hour.

/Box on p 20: RAM B7--Portable Device for Detection of Radiation/

RAM B7 is a portable instrument for detection of radiation intended to monitor several types of radiation. The instrument employs the CMOS technology with the goal of saving energy. The instrument, based on a microcomputer, has an LDC terminal which enables clear indication of the work conditions. Several types of detectors can be hooked up to the RAM B7. It supplies the detectors with a low frequency and in return receives a logical symbol whose frequency is relative to the field of radiation. The instrument is capable of auto-ranging with alarms which were included in it when programmed. RAM B7 and the detectors are packaged in waterproof material, in order to enable them to operate in difficult environmental conditions and to facilitate decontamination. The system meets the requirements of MIL-STD-810C.

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LIBYA

FOREIGN LIAISON BUREAU ON NUCLEAR TEST BAN

LD261823 Tripoli Domestic Service in Arabic 1700 GMT 26 Dec 85

["Statement" by the People's Committee of the People's Bureau for Foreign Liaison on the Socialist People's Libyan Arab Jamahiriyah's "support for halting the nuclear arms race and all nuclear tests and explosions"]

[Text] While stressing the Socialist People's Libyan Arab Jamahiriyah's support for halting the nuclear arms race and all nuclear tests and explosions, whether underground or in space, due to the resulting destruction and affliction to humanity, the People's Committee of the People's Bureau for Foreign Liaison believes that the Soviet initiative, represented in its declaration to halt unilaterally nuclear explosions and tests until the end of 1985, is a positive development. This may lead to the creation of objective conditions for curbing the arms race and distancing the specter of nuclear war from humanity.

The United States and other countries are urged to respond to this Soviet initiative by halting their underground nuclear tests. The People's Committee of the People's Bureau for Foreign Liaison urges world public opinion, peace-loving countries and popular forces, and organizations to continually struggle to attain humanity's desired objective of realizing world security and peace by halting underground nuclear tests and preventing the spread of the arms race to space.

/6091
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PAKISTAN

INDO-U.S. COLLUSION ALLEGED IN 'BOMB CAMPAIGN' AGAINST PAKISTAN

Karachi JANG in Urdu 9 Nov 85 pp 3, 14

[Text] The well-thought-out campaign that Indian Prime Minster Mr Rajiv Gandhi began against the Pakistani nuclear program a few months ago has reached its zenith. In 1971, India used the issues of violation of human rights and refugees to make Pakistan look guilty in the eyes of world public opinion. Our friends were put in a difficult spot and, despite their desire to help us, they were afraid to come out on our side. This is the wonder of political governments that in any situation they find ways to attain their national interests. In 1971, India played the card of refugees coming from East Pakistan very expertly and now it has raised the bogey of the Pakistan atomic program with so much success that Pakistan is left with no alternative but to resort to explanations. We know the weaknesses of nonpolitical regimes. In 1971, Pakistan was the country from which refugees had left. Within 9 months, India had not only inflicted a military defeat on Pakistan but also washed its hands of responsibility for the refugees. Against this, in 1978, Pakistan became the host to refugees. Six years have passed, and we have neither sent the refugees back nor have we taught a lesson to Afghanistan. If today Kabul has the backing of the Soviet Union, then in 1971 Yahya Khan, too, claimed the support of America. Even today we swear by the pro-Pakistani attitude of Nixon and Kissinger. To this day it is not known what they accomplished. War on the western front was stopped following a call from Brezhnev, and East Pakistan had been occupied by India. Meanwhile, America is our friend, and the blessings of our nonpolitical regimes amount to this. If, as in 1971, refugees go from our country, we are punished and if, as in 1978, refugees come to our country, we are still punished.

The atomic argument has now reached a critical stage. The fact is that with its 1974 atomic test, India has acquired the capability of making a bomb. But it has made such an issue of the Pakistan atomic bomb, of which there is not a trace, that even our best friend, America, is afraid of coming to our side, and our tested and tried friend, China, thinks it best to take refuge in silence. Our loneliness in the world on the subject of an atomic program is no different than our loneliness in 1971 on the issue of refugees. At that time, too, America agreed on the seriousness of the problem and the Indian wishes to resolve it. Only over the means there was a difference of opinion. Today, too, America shares the Indian concern over the Pakistan

atomic bomb and both are agreed that Pakistan should be prevented from building the supposed atomic bomb. In 1971, too, friends of Pakistan were reluctant to support us on the question of violation of human rights and today, too, they find themselves helpless in supporting us on the issue of building an atom bomb. So far as there is the question of making an atom bomb, the people of Pakistan are under no illusions. This nation has suffered a great tragedy. It knows full well the complete story of the reprocessing plant and the nature of the present regime. Why would a government that has made the offer of a friendship pact to India build an atom bomb? What are the reasons for doubting President Zial Haq's statement that Pakistan is not building an atom bomb? America, as well as India, knows full well that Pakistan's atomic program is only for peaceful purposes. THE NEW YORK TIMES wrote only last week: "Officials of the Reagan administration have privately admitted that they do not believe that Pakistan is making an atomic bomb." Despite all this, why is this campaign going on? The answer to this question can be obtained only by analyzing the respective interests of India and America.

India is reaping immense advantage from the atom bomb campaign. Notable among these are: 1) A Pakistani atomic program is a stick with which America is continuously being beaten. Public opinion in America, as well as in western Europe, is being mobilized against the so-called Reagan administration's policy of tilt towards Pakistan, especially the Jewish lobby that supports Israel. As a result, the Reagan administration has been put on the defensive, and it is obliged to be cautious in its dealings with Pakistan. It has very important consequences. 2) Under cover of this campaign, India rapidly advanced its own atomic program, and it would not be surprising if it has already made the bomb. (This is very important.) 3) This campaign is being used to suppress internal opposition in India. 4) World opinion has been prepared for an attack on atomic facilities of Pakistan, and it has been seen to that in case military action is taken against Pakistan in the name of knocking out atomic installations, no one will come to the aid of Pakistan. In this context, it is enough to note that even after the disclosure of Indian plans to attack Kahuta, neither America nor China has yet said what they would have done in the event of an Indian attack or what their reaction would be in case of an attack in the future.

There is only one danger in this last contingency, and that is the reaction of Pakistan. It is true that in reply the foreign minister has threatened a full-scale war. In 1971, Yahya Khan personally made such a threat, and India witnessed its reality. But I feel that today conditions are very different. This time, in case of an attack, Pakistan can surely inflict huge losses on India, and the clock in the subcontinent can be put centuries back. It is another matter that destruction is no guarantee of freedom's safety and that this is not a proper choice. But there are several other possibilities. Sahibzada Yaqub Khan says that an attack on Kahuta will be considered a full-scale attack. A few days back, in a press conference in New Delhi, while speaking on a proposal for mutual inspections, Mr Rajiv Gandhi said, "It is not necessary for Pakistan to keep in its centers the uranium needed for building the bomb. It can be hidden anywhere." If our honorable foreign minister examines this in the light of his military experience, he will

realize that India has gone beyond the limit of merely attacking Kahuta. Now it has got the option of attacking any place. All it has to say is that "in this place there was a store of bomb-grade uranium." Now the danger is not merely of an attack on Kahuta. Very skillfully India first started the atom bomb campaign and now, in this context, it has made all of Pakistan the target of its attack. Modern battles are fought on the political front. India has cleverly played the card of a Pakistani atom bomb. Now if it wants to embark on aggression, then Mr Rajiv Gandhi has already won half the battle through his political moves. He has obtained an agreement on the principle of stopping Pakistan from building an atom bomb and, interestingly enough, America has reverted to the position of 1971. Then it accepted secession of East Pakistan. Only on the means did it have differences with India. Today, it accepts the principle of stopping Pakistan from building an atomic bomb. Today, too, the differences are only over means. In my opinion, the differences today are much narrower than in 1971.

In this context, that innocent remark by Mr Rajiv Gandhi is meaningless where, while expressing his amazement, he stated: "President Reagan said to me that you should stop Pakistan from building an atom bomb before the Pakistani atomic program reaches a point of no return." Rajiv Gandhi said, "I do not understand what the President meant by this." One cannot help applauding the cleverness of this innocence. Full of warning as the remark was, more dangerous were the explanations offered by America. The remark was made by President Reagan on a personal level with the administrative head of India, but the explanations have been issued on lower official levels. Even these explanations do not deny the remark. Only the interpretations are said to be different. In other words, there is no dispute at all over "stopping Pakistan." In a recent issue of THE NEW YORK TIMES, the above remark by President Reagan is presented like this: "We must not allow Pakistan to reach a stage from which it is not possible to come back." These remarks are by the American president. There is no question that India will have any disagreement with this. This agreement between these two powers can become the basis of a big step.

If, according to THE NEW YORK TIMES, even officials of President Reagan's administration know that Pakistan is not building an atom bomb, then why is the American government becoming a party to this "bomb campaign"? The answer to this is very simple. Pakistan is not in the list of permanent interests of America. These regions start from west of the [Persian] Gulf. Israel is the center of American interests in the region. There is no doubt that Pakistan has acquired enough capability and expertise in the atomic field. If not today then tomorrow, if a political decision is taken, our scientists are in a position to deliver a bomb. A Pakistan atom bomb is a death knell for Israel. America will not court this danger under any circumstances. The American concern is that, taking advantage of the present conditions, guarantees should be obtained that Pakistan will never be able to build a bomb in the future and, in case it does want to build the bomb, the big powers should have the right to stop it by force. This is a serious conspiracy against Pakistan. This is a bigger conspiracy than even the effort to destroy the reprocessing plant. This plan is obviously in accordance with the wishes of India. That is why it started the bomb campaign. It is not

too farfetched to believe that India may have obtained American consent before starting this campaign. This suspicion is not misplaced. The final question is whether, to prevent Pakistan from building an atomic bomb, world intimidation will be brought to bear to shackle Pakistan to agreements or force will also be used. Here there may be a difference between the positions of America and India. It may be that America hopes, by making Pakistan friendless in the world, to scare it into accepting any kind of agreements to go without an atom bomb. Obviously, it is also China's interest that, under the influence of the idea of a bomb-free zone, an idea that has emerged in the course of this controversy, India may provide world guarantees for not building an atom bomb. This should be its natural reaction. But there is no salvation in this for Pakistan. Keeping in view its claims of friendship, we can accept that America wants to limit the "bomb campaign" merely to pressure us so that Pakistan will accept atomic restrictions forever. But will this be the objective of India also? It is difficult to believe this. India feels that in view of the atmosphere created as a result of the "bomb campaign" it will not face any significant opposition if it takes steps to destroy Pakistan's military power under cover of knocking out atom bomb installations. This impression is fraught with dangers. In view of India's mentality, there is lot of temptation in this. It should be kept in mind that in 1971 Mrs Gandhi had given orders to the military commanders that "military power in West Pakistan should also be destroyed." A friendly ambassador had accordingly passed it on. This action was stopped as a result of a telephone call from President Brezhnev. But, today, conditions are different. America agrees with the basis for attack which India has created. And how are our relations with Moscow? It will be enough to note that until 1971 Moscow had never accused Pakistan of killing any Soviet soldier. From this, one can realize what kind of dangers are threatening the country. The conspiracy to finish Pakistan's atomic option once and for all is now complete. America wants to achieve this objective without destroying Pakistan's military power. India will definitely wish otherwise. On the basic objective, both are in agreement.

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PAKISTAN

POSSIBILITIES OF INDIAN ATTACK ON KAHUTA DISMISSED

Lahore NAWA-I-WAQT in Urdu 16 Nov 85 p 3

/Article by Abuzar Ghaffari: "Danger to Kahuta Atomic Plant!"/

/Excerpt/ India has to consider several facts before an attack on Kahuta. First, the target is very crucial and must be aimed at carefully. The Indian Air Force must attack during daylight time. An air attack at night will not be effective. It is essential to fly low for a daytime air raid. It means that Indian airplanes must fly low when attacking the atomic plant at Kahuta. In June 1981, when Israel attacked and destroyed the atomic plant in Baghdad, the writer of these lines was in Baghdad after observing the conference of Islamic Foreign Ministers. The Israeli attack began just before sunset and was over in a few minutes. Iraq had never even imagined that Israel would attack their atomic plant. This attack was so unexpected that Iraq neither used any anti-aircraft missiles nor sent any airplanes to ward off the attack. When the Israeli airplanes had returned after completing the mission, Iraqi antiaircraft artillery began to fire heavily. The strength of this firing clearly indicated that, had they fired in time, the Israeli mission would never have been successful.

Thus, India must assure that its air attack on Kahuta is so sudden that the Pakistan Air Force does not have time to defend it. The Indian desire to attack Kahuta is so well known that Pakistan has already taken necessary defensive measures. The selection of the hilly site in Kahuta was made for defense reasons. Pakistan is confident of defending its atomic plants. Narsimha Rao, India's foreign minister, had announced on 12 December 1980 when Breheznev was visiting India that according to news reports Pakistan was making atomic weapons. He had added that India was taking steps to protect itself. In response, President Ziaul Haq had said at Bahrain on 18 January 1981 that Pakistan has the ability to defend its nuclear plants and it is willing to accept India's challenge. We can assume that it is not possible for India to attack Kahuta.

India will lose heavily if its attack is not a surprise. Even if Indian airplanes manage to reach Kahuta by flying low to avoid detection by Pakistan's radars, they must fly high to cross the mountains near Kahuta. At that time they will fall prey to Pakistan's antiaircraft artillery. India knows this and has never dared to attack Kahuta despite its repeated threats. India will be greatly humiliated if its attack on Kahuta fails. Also, Western countries, especially the United States, will stop providing technical assistance to India.

The second reason that deters India from attacking Kahuta is that such an attack would have widespread implications. There were fears of an Indian attack on Kahuta and /Pakistani-held/ Kashmir when Indira Gandhi declared on 11 December 1981 that situations similar to 1971 had developed on their borders. General Zia told newspaper editors on 1 January 1981 that there would be a large-scale war if a superpower tried to pressure Pakistan via Afghanistan or used another country to make trouble on our borders or attack our atomic plants. He said that people who wanted to destroy Pakistan before it got F-16 fighters from the United States were hoping for too much. He added that Pakistan was no weakling and could defend itself. This was a clear message to India. If India makes trouble in Kashmir or attacks Kahuta under pressure from the USSR, Pakistan would go to a full-scale war. Recently, on 29 October 1985, Foreign Minister Sahabzada Yaqub Khan declared in the Senate that an Indian attack on the Kahuta atomic plant will be considered a full-scale declaration of war. He assured that Pakistan has taken necessary steps to defend Kahuta and will retailiate against an Indian attack with full force.

Actually our president's declaration that an Indian air raid on Kahuta would be considered an attack on the whole of Pakistan has put India in a difficult situation. India is aware that it must be prepared to wage war with Pakistan before it dares to attack Kahuta. India is not ready for that now. As mentioned earlier, India was hoping that, after the Russian takeover of Afghanistan, Pakistan with the majority of its armed forces stationed on its western border would leave its eastern borders open for easy annexation by Indian Armed Forces. The Ayghan mujahidin, however, by keeping the Karmel armies away from the Pakistani borders, have poured cold water on Indian designs. By protecting the Afghan-Pakistan border, the Afghan mujahidin have made it possible for Pakistan to reserve its whole armed forces for an attack by India. Now it is not possible for India to destroy the Pakistani Army in a few days. General Zia is correct in his statement that the Afghan mujahidin are fighting Pakistan's war. An Indo-Pakistani war will force the two superpowers to join in and will result in the third world war. India is aware that Pakistan can take advantage of the Sikh unrest in Punjab and help establish Khalistan and that Kashmiri Muslims might rebel against India. The third reason why India will not attack Kahuta is the fact that Pakistan is a strategic ally of the United States. The United States will never allow its important ally to suffer heavy casualties or embarrassment. The United States considers an Indian attack on Kahuta as a challenge to itself because it is aware of the Soviet interest and hand in such an attack. Therefore, it is in the U.S. interest to stop a Soviet or Indian attack on Kahuta. The United States' decision to help Pakistan with atomic technology has disturbed Rajiv Gandhi very much. It was said that President Reagan was concerned about Pakistan's atomic program when Rajiv Gandhi visited the United States in June 1985. He was supposed to pressure Pakistan not to make an atomic bomb. When Rajiv went to New York last October to tell that Pakistan has already made an atomic bomb, the President told him that Pakistan had no atomic program and advised him to negotiate with Pakistan directly on this issue. The Indian prime minister believes that the United States is aware that Pakistan has an atomic bomb, but does not want to discuss it.

We are glad to learn that, finally, Rajiv Gandhi knows that the United States will help Pakistan at all costs. Now, before attacking Kahuta with Soviet

help, India has to think what steps the United States will take to help Pakistan. Pakistan and the United States know how the Soviet AWACS airplanes had made the Pakistan Air Force totally ineffective. We have made necessary arrangements to ensure that the USSR does not jam our radars. This would be an electronic war and the United States is bound to win it. The United States will also monitor Indian airplanes from its satellites. Just before Mrs Gandhi was assassinated India had moved some of its Jaguar fighter planes from one base to another. U.S. satellites observed this movement and the discussion that followed in the U.S. Senate was heard all over the world. The CIA is also of great help in informing us of Indian designs and plans.

The people in the United States will be greatly upset with India if India decides to attack Pakistan since President Reagan has told Rajiv Gandhi to negotiate directly with Pakistan to stop nuclear proliferation in the subcontinent. At the same time Rajiv Gandhi's campaign to obtain modern technology will fail badly. The United States and other industrialized countries in the free world will refuse to help India with modern technology. The U.S. offer of super computer technology to India is very important. President Reagan is offering this high technology to India, but at a price. India has to promise not to attack Pakistan so the latter can focus its energies on the danger posed by the Soviet Union.

The fourth reason why India will not attack Kahuta is the possible hazard to citizens in Rawalpindi and Islamabad if the nuclear plant is damaged. The destruction caused in the embassy row in Islamabad by nuclear dust would make world headlines. India also knows that if it hurt Pakistani people with an atomic bomb, Pakistan is capable of doing the same to its citizens.

The fifth reason is that Pakistan can also attack Indian atomic plants. India could attack Pakistan and not fear retaliation before the arrival of F-16 bombers. The situation changed when these planes arrived in Pakistan in October 1982. Now India knows that if it attacks the Pakistani atomic plant Pakistan will do the same. India's atomic plants near Bombay are within the range of F-16 airplanes.

Now, if India attacks Kahuta with help from Israel, we will say that Pakistan is not Iraq. At this time when Pakistan is fully prepared, the question of an Indo-Israeli air raid just does not arise.

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PAKISTAN

BRIEFS

CANADA TO END NUCLEAR FUEL SUPPLIES--Islamabad, 21 Dec (AFP)--Canadian Foreign Minister Joe Clark said here today that his country would not resume nuclear fuel supplies to Pakistan. After talks with Pakistani officials during a three-day visit here, Mr Clark told a news conference that Islamabad did not seem ready to adhere to Canada's "strict standards" for nuclear cooperation. Canada had agreed to supply fuel to the Karachi nuclear power project, but changed the standards for such cooperation after India exploded a nuclear device in May 1974. The nuclear cooperation agreement between the two countries ended in 1976, when Pakistan refused to allow Canada access to all of its nuclear facilities. But Mr Clark said Canadian aid for the development of conventional energy resources would continue. Today, he signed an 80 million Canadian dollar (59 million U.S. dollar) assistance programme to increase production at the Tarbela Dam project, 70 kilometers (44 miles) northwest of here. He also pledged Canada's continued support to Pakistan on the Afghanistan issue and relief assistance for displaced Afghans. [Text] [Paris AFP in English 1800 GMT 21 Dec 85 NC] /9274

CSO: 5100/4730

IVORY COAST

BRIEFS

HOUPHOUET RECEIVES IAEA DIRECTOR--President Felix Houphouet-Boigny yesterday granted an audience to Dr Hans Blix, director of the International Atomic Energy Agency [IAEA] who explained to the head of state that apart from the fabrication of bombs, the IAEA can contribute to the development of agriculture and preserve products [preserver les productions] from all calamities. This was why Dr Hans Blix made it a point to pay courtesy visits to the ministers of rural development and agriculture. He also visited the university laboratory of nuclear sciences at Cocody and the laboratory of animal nutrition. [Text] [Abidjan FRATERNITE MATIN in French 15 Jan 86 p 6] /8309

CSO: 5100/12

SENEGAL

BRIEFS

DISCUSSION ON NUCLEAR ENERGY--Dakar, 10 Jan (AFP)--Hans Blix, director of the International Atomic Energy Agency (IAEA) said in Dakar that Africa would have made a great step toward denuclearization if Pretoria had agreed to the verification of its nuclear energy installations. Mr Blix stated this to the SENEGALESE NEWS AGENCY after he had been received in audience by the Senegalese head of state, who is also the current chairman of the OAU. The director of IAEA, who is on a 3-day official visit to Senegal, disclosed that he discussed with President Diouf ways and means of developing cooperation between the IAEA and developing countries for the use of nuclear energy for peaceful purposes. The IAEA currently cooperates with Senegalese Nuclear Technology and Agricultural Research Institute. [Text] [Paris AFP in French 1745 GMT 10 Jan 86] /8309

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USSR

ANATOLIY GROMYKO ON CONTROL OF NUCLEAR THREAT

Moscow IZVESTIYA in Russian 10 Aug 85 p 5

[Article by Anatoliy Gromyko, corresponding member of USSR Academy of Sciences: "Kill the Nuclear Leviathan!"]

[Text] In today's world, a world that is well informed about the possible calamities of the thermonuclear catastrophe, there has been born, as though all by itself, the reassuring idea that no governmental leader will risk beginning a nuclear war, and the arising of such a war is possible only as a result of a fatal error or accident. But even the latter is completely inadmissible. Putting it more briefly, in Washington and the NATO capitals many extremely respectable people seem to be convinced that the only thing to be feared is a short circuit in a computer or a terrorist acting on his own. But what if the "short circuit" occurs in the head of one of those persons who has been invested with the right to use nuclear weapons?

The proliferation of nuclear weapons is sometimes felt to be inseparable from scientific-technical progress. People at such time forget that the twentieth century, which crowned the heights of the achievements of human intelligence with avalanches of nuclear danger that are ready at any moment to come crashing down on people, has posed in all its fullness one of the key questions of civilization -- the question of the moral preparation of man for his constantly expanding transformational capabilities.

People recall, in particular, the words which the leading natural scientist, Academician V. I. Vernardskiy expressed at the very beginning of the 1920's. Looking with bright hope and simultaneously a large amount of alarm at the still scarcely distinguishable contours of the future Atomic Age, he said, "We are approaching a great turning point in the life of mankind, with which none of the ones that have been previously experienced can be compared. The time is not far off when man will get in his hands atomic energy, that source of power which will give him the capabilities of building his life the way he wants it. That can happen within the next few years, or it can happen within a century. But it is clear that this must be. Will man be able to take advantage of that force, to channel it toward that which is good, rather than toward self-annihilation? Has he grown to the point of knowing how to use that force that science must inevitably give him?"

Unfortunately, not all of mankind has proven to be morally prepared to receive nuclear energy in its hands. Less than a quarter of a century separated V. I. Vernadskiy's prophetic words from the nuclear explosions at Hiroshima and Nagasaki.

A new natural law is taking on decisive importance in international relations at the end of the twentieth century. One cannot achieve a unilateral advantage for oneself to the detriment of the security of others, and without in the final analysis also inflicting harm on oneself. This natural law was well understood by the most far-sighted and sober-minded contemporaries of the dawn of the Nuclear Age, or in any case by those whose minds had not been captured by various kinds of concepts of strength.

By no means everyone, however, realized that the appearance of mass destruction weapons of a force that threatens to become uncontrollable changes not only the role of those weapons and the attitude toward a war that employs them, but also the definition of the priorities in the sphere of the major concerns of mankind. To the fullest degree this manifested itself in the course of the "nuclear arms race," the entire history of which became a brilliant testimony to the futility of the attempts to guarantee security at the expense of military superiority. Every time that the United States attempted to achieve unilateral advantages by means of developing new types of weapons and making them standard equipment, they forced the Soviet Union to take retaliatory measures. As a result the spiral of the arms race took a new and more dangerous twist, and kept developing more and more sharply along the vertical.

It is improper to equate the special responsibility borne by the countries possessing nuclear weapons for the fates of the world with the "equal responsibility" borne by those countries for the heating up of the international tension. The USSR bears no responsibility for the latter, because if one follows that "logic" one could also, with a serious appearance, place the equal sign between the scientists who discovered atomic energy and the American political figures who made the decision to carry out the nuclear bombings. The world has not forgotten the specific political situation in which that sinister decision was once made.

Nuclear weapons were used by the United States against Japan under extremely strange circumstances. Their use was not justified by military goals. By that time militaristic Japan had been substantially defeated, including the situation in which, by the strength of Soviet weapons, its very powerful Kwantung Army had been forced to surrender. By dropping atom bombs on Hiroshima and Nagasaki, Truman and those surrounding him were, as it were, hurrying to announce to the entire world, but primarily the Soviet Union, their monopoly with this terrible supermurderer weapon. The existence of atomic weapons, in their opinion, was supposed to guarantee for them a special role as "military leader." That was moral degradation.

Attempting to shake off from themselves the terror inspired by the principle of "balance of fear," substantiated by the hypothesis that, in the event of nuclear attack, the other side would still have sufficient means for a retaliatory annihilating strike, the "nuclear optimists" have not found

anything better than to talk about the inflicting of a "decapitating" strike or the waging of a "limited," "prolonged" nuclear war. It is assumed that the European theater of military actions can become its arena. At such time, however, they remain silent about the fact that the idea concerning the "limited" application of nuclear weapons in Europe can be extended to other regional crisis situations.

There exists an aphorism that "A pessimist is a well-informed optimist." I do not think that "nuclear optimism" has any shortage of information. We are dealing, rather, with something else. We are dealing with the attempts to disregard the data that scientists already have at their disposal concerning the pernicious effect that nuclear war can have on the climate of the earth and its ecology.

The danger of the escalation of the nuclear arms race is growing not only as newer and newer systems appear, and one observes, so to speak, the maturation of the material prerequisites for the horizontal proliferation of those arms. The danger is linked in the most direct manner with the very spirit of the arms race, with the existence of the philosophy of nuclear intimidation.

Literally from the moment of the creation and application of the first atomic bomb, at all stages of the acceptance as standard equipment of new systems of nuclear weapons, and ending with the very latest ones -- the U.S. "strategic defense initiative" that stipulates the further militarization of space -- the nuclear race has been justified, and is still being justified, by NATO by the "concern" for the preservation of the peace. It is sad, or even tragic, that the illusion of the possibility of guaranteeing peace and security under a "nuclear umbrella" is still being disseminated much more rapidly than even the nuclear weapons themselves, and is becoming, in the final analysis, a narcotic impetus that encourages certain countries to enter the "nuclear club."

The appearance in new countries of several, or even dozens of, nuclear warheads and the means of delivering them is complicating the monitoring of nuclear weapons, and is increasing on a global scale the factor of indefiniteness and the increase in the distrust and the reciprocal suspicions in international relations, and, I would say, will subject to additional strain the "nerve system" of nuclear policy, which has already been strained to the limit.

Serious concern is also caused by the attempts to undermine the existing conditions to prevent the proliferation of nuclear weapons. Thus, despite the principles stated in the Nuclear Nonproliferation Treaty, the nuclear powers of the West have discontinued their negotiations with the USSR concerning the complete and universal banning of nuclear arms tests. Such governments as the Republic of South Africa, Israel, and Pakistan, with the short-sighted support of the Western countries, and primarily the United States, are attempting with special stubbornness to break through the breaches in the system of measures that are aimed at the nonproliferation of nuclear weapons.

A no less serious blow at the antiproliferation conditions is being dealt by the deploying by the United States and NATO of mass destruction weapons and the meaning of delivering them outside the confines of their own territory.

The military activity of the United States and the other NATO powers, which has caused a retaliatory reaction from the USSR and the OVD [Warsaw Pact Organization] in defending their security, is a serious obstacle on the path of creating nuclear-free zones that could become an effective means of reinforcing the idea and practice of nonproliferation.

The U.S. plans to saturate space with weapons are raising the arms race to a qualitatively new level, that defines the direct interrelationship between nuclear weapons "along the vertical" and its proliferation "along the horizontal." Already, at the stage that is called by the American representatives the "stage of scientific-technical developments," the United States is attempting to involve in the preparation of a war in space not only its NATO allies, but also countries that are directly located in the zone of real armed conflicts. It is extremely indicative that Israel was one of the first countries to declare its readiness to fasten itself closely to the "Star Wars" plans. In addition, although the "Star Wars" program is taking only its first steps, it is already, essentially speaking, causing a fever throughout the world, leading to the destabilization of global international relations, and sharply aggravating the political and military confrontation.

There is just one way out of the critical situation that has been created -- the cessation of the arms race and the transferral of the liberated funds to meet the needs of universal development. It is only a policy of peaceful coexistence with various socioeconomic systems that is the sole intelligent formula for international relations. It is necessary for countries to learn how to live not against one another, but with one another.

The refusal to use force as the absolutely fundamental principle of modern international relations presupposes the further increase in the foreign-political activity of absolutely all the countries in the world, irrespective of their economic potential or military might. In the person of six countries -- Argentina, Mexico, India, Thailand, Greece, and Sweden -- which came out with a joint declaration in May 1984 which called for the complete cessation of the development, production, and deployment of nuclear weapons and means of delivering them, for the freezing of the nuclear arsenals, and the initiation of steps to reduce them, we see realists in the struggle to improve the international situation.

A tremendous role in this matter is played by the decision of the Soviet Union on a unilateral basis to discontinue any nuclear explosions starting on 6 August 1985. The joining in of the United States in this wise action, as General Secretary of the CPSU Central Committee M. S. Gorbachev noted, would be an important contribution to the reinforcement of the strategic stability and peace on earth.

There are, unfortunately, figures who feel that every generation must travel its own path of trial and error, must experience, so to speak, history with its own life. They assert that there are things a bit more important than peace. I am afraid that for the nuclear age this view is hopelessly obsolete and it would seem that there will no longer be anyone to learn from the errors that our generation is taking the risk of making.

Do the NATO political figures, and primarily those of the United States, have sufficient wisdom and bravery to stop the vertical growth of the nuclear arms race and to close off the channels of its proliferation along the horizontal? That is a question not of academic curiosity. Its resolution will determine the fate of mankind as a whole and the fate of every person individually.

Biblical mythology mentions Leviathan as a terrible monster that was hostile to God and that was smitten by the Almighty. That gigantic snake embodied the destructive forces. It is no accident that in his monstrous jaws the great painter El Greco saw the gates of Hell, and depicted them in one of his apocalyptic paintings.

Today our world is being torn apart and is being threatened with destruction by a nuclear Leviathan that is being nurtured by greedy militarism. In order to prevent this from happening, it must be bridled and killed. And in real life this can be done only by people, by their intelligence and their deeds.

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USSR

CEMA NUCLEAR ELECTRIC POWER, HEAT PRODUCTION

Technical Aspects, History of CEMA Nuclear Cooperation

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 9, Sep 85 pp 12-16

[Article by Andranik Petrosyants, chairman of the USSR State Committee for Utilization of Atomic Energy, chairman of the CEMA Permanent Commission for Peaceful Uses of Atomic Energy; and Aleksandr Panasenkov, CEMA Secretariat department chief; under the rubric "Integration in Action": "The Atom's Energy--for Creation"]

[Text] The SEV [CEMA] Permanent Commission for Cooperation in the Area of Using Atomic Energy for Peaceful Purposes, created by the council session in 1960, is marking its 25th anniversary. As is indicated in the commission's regulations, its task is comprehensive examination and solution of the most important multilateral cooperation problems in the given area, foreseen by the Comprehensive Program of Socialist Economic Integration, through long-term special-purpose [ad hoc] cooperation programs, and integrated measures in the areas of energy, fuel and raw materials.

All CEMA member countries, except the Mongolian People's Republic [MNR], participate in the commission's activity. Yugoslavia takes part in its work on individual matters of mutual interest.

I

In the commission's first decade (1960-1970), attention was concentrated upon developing national scientific research centers, in which nuclear reactors and charged-particle accelerators were installed, and constructing physics and radiochemistry laboratories outfitted with modern equipment. The training of scientific and engineering personnel played a special part during this period.

Creation of large experimental bases and test facilities, as well as initiation of nuclear electric power plant [AES] construction, furthered expansion of the cooperation within the commission's purview on many problems--equipping thermal and fast-neutron atomic reactors, nuclear instrument manufacturing, radiation protection equipment, reprocessing fuel irradiated in reactors, detoxifying and burying radioactive waste materials, technology for obtaining radioactive isotopes, using radioisotope equipment, transporting radioactive materials, ensuring radiation safety when using atomic energy, and others.

Working agencies of the commission, which launched their activity on the basis of the coordination plans for scientific research and technical developments, were formed after adoption of the comprehensive program.

During the 25 years, 1,550 questions on urgent cooperation problems have been examined by the commission and its agencies, and about 700 measures, in which over 27,000 specialists took part, have been carried out.

The formation, by commission decision, of a number of international organizations (economic associations, scientific collectives, representative councils, and others), operating on the basis of appropriate agreements, played an important part in broadening cooperation.

The International Economic Association for Cooperation in Nuclear Instrument Making [Interatominstrument], created in 1972 on the commission's initiative, has done much work in organizing the specialized production of instruments and nuclear equipment items. An agreement, effective within the association's purview at the present time, provides for division of labor in the output of 187 kinds of articles, which are included in 17 nomenclatural groups. Specialized production's share in the overall goods-turnover volume of the international economic association [MKhO] exceeds 50 percent, which amounts to about 50 million exchange rubles per annum. The association has been operating on a self-sustaining economic basis since 1978, due to revenues from the sale of administrative contracts and the services of its branches in the People's Republic of Bulgaria [NRB], Polish People's Republic [PNR], and USSR.

An agreement on multilateral international specialization and cooperative amalgamation in the manufacture of isotope-production articles, signed in 1974 between the Hungarian People's Republic [VNR], German Democratic Republic [GDR], PNR, Socialist Republic of Romania [SRR], USSR, and Czechoslovak Socialist Republic [CSSR], has permitted ensuring the production of a wide range of radioactive and stable isotopes, ionizing radiation sources, tracer preparations for medical purposes, and others.

Today the agreement's product list encompasses products of about 1,500 kinds. Their quality is being steadily improved. The volumes of reciprocal deliveries are increasing. The agreement will be extended for the third time--to cover the years 1986-1990.

A temporary international collective (VMK) of scientists and specialists in the physics of reactors of the VVER [water-moderated, water-cooled nuclear power reactor] type has been operating in Budapest since 1972. Specialists from nine CEMA member countries, as well as Finland, participate in its work. An experimental zero-power reactor has been constructed, under administration of the VNR Academy of Sciences Central Institute for Physics Research [TsIFI], for conducting the joint work.

During the VMK's time of operation, uniform programs have been created for the physics calculations of reactors and the metrology of measurements in their

start-up and use in an AES. Characteristics of the fuel assembly lattices are being investigated, a series of steps is being taken to optimize nuclear fuel overloads, and new methods of VVER core diagnosis are being developed for introduction into AES's.

II

As is well known, one of the main ways of increasing a national economy's effectiveness is efficient use of energy resources. The brother countries are solving this problem, first of all, through accelerated development of the atomic power industry on the basis of united efforts. And here is the result. At present, the total capacity of AES's operating in Bulgaria, Hungary, the USSR, the GDR, and Czechoslovakia amounts to more than 30,000 megawatts; including 1,760 megawatts in the NRB, 880 in the VNR, 1,830 in the GDR, over 25,000 in the USSR, and 1,760 megawatts in the CSSR. The generation of electric power at these AES's has reached approximately 180 billion kilowatt-hours, which is equivalent to the saving of about 60 million tons of conventional fuel.

According to the industry's development plans, the total capacity of AES's in CEMA member countries will amount to about 40 million kilowatts in 1985. The generation of electric energy at them will exceed 230 billion kilowatt-hours, which, in tentative calculation, will permit the replacement of 70 million tons of fossil fuel. It is expected that the total capacity of AES's will reach 100 million kilowatts during the next 10 years. Their contribution to electric energy production in the individual countries will constitute 20-30 percent, but over 40 percent in the NRB.

Today, the atomic power industry in the majority of CEMA member countries is being developed on the basis of series-produced, water-moderated, water-cooled power reactors of 440 and 1,000 megawatt capacities. In the USSR, channeled boiling-water reactors with graphite moderator (RBMK's) of 1,000 and 1,500 megawatts also have received development.

To date, 24 units [bloka] with VVER-440 [440 megawatt VVER] are in operation in CEMA member countries; including 4 units at the Kozloduy AES in the NRB, 2 at the Paks AES in the VNR, 4 at the Bruno (Leuschner) AES in the GDR, 10 at the Novovoronezhskiy, Kola, Rovno and Armyansk AES's in the USSR, and 3 units at the (Bogunice) AES and 1 at the (Dukovany) AES in the CSSR. Through 1990, it is proposed to bring about 20 more units with VVER-440 into operation in the VNR, GDR, Republic of Cuba, PNR, USSR and CSSR.

The experience in operating an AES with these reactors shows that they are reliable sources of electric energy production. The AES's cost of production, despite the higher capital outlays, is lower in this case than at a TES [thermal electric power plant] using fossil fuel.

The next stage in atomic power industry development is associated with launching the construction of AES's with reactors of 1,000 megawatt capacity. Their

placing in operation will permit increasing capacities at higher rates, with simultaneous reduction in the proportional outlays of metal, building materials, and fuel. The first AES's with VVER-1000 already are operating in the USSR. Construction of the lead unit with a reactor of this type is being completed in the NRB. Construction agreements for such AES's have been concluded in the GDR, SRR, and CSSR. In the future, these will be drawn up in other CEMA member countries as well.

Taking the important meaning of the VVER-1000's into account, CEMA member countries signed an agreement, in 1980, on mastering and further improving them. On its basis, physics and thermohydraulics research has been organized, as well as research on ensuring safety; and new kinds of equipment and technological and operating rules are being developed. Among these, the following have special significance:

A diagnostic system for inspecting the condition of the VVER core and equipment in the process of AES operation, which got its "start in life" through the joint efforts of four countries (VNR, GDR, USSR and CSSR) (It was awarded the Leipzig Fair's Gold Medal in 1984);

a large heat-extraction loop installation [includes pump, steam generator, piping from and to reactor, etc.] for conducting joint work on safety of reactors at the "Mariya" experimental nuclear reactor in the PNR;

investigation of the heat-exchange crisis and heat-engineering safety of VVER-type reactors being carried out in the VNR, USSR and CSSR on large thermohydraulics test stands;

creation and manufacture of prototypes for a modernized, stepwise actuator of the control and protection system (SUZ) for VVER-1000's, as well as issuance of the technical documentation for putting these into series production, in the USSR and CSSR.

At the suggestion of our committee, the Intergovernmental Commission (MPK) for Cooperation in Producing Equipment for Nuclear Electric Power Plants made the decision, in 1983, that all new kinds of equipment and devices would be turned over to the MPK for organizing their specialized production, taking into account the contributions of individual countries in their development.

III

As they gain experience, it also is intended to organize cooperation of interested countries in the use of nuclear fuel for centralized heat supply. At present, by CEMA Executive Committee decision, draft agreements and cooperation programs for CEMA member countries are being developed within the purview of the CEMA Permanent Commissions for Cooperation in the Area of Electric Power and the Area of Using Atomic Energy for Peaceful Purposes in scientific and technical and planning work in the area of atomic heat and electric power centers (ATETs's) and atomic heat supply plants (AST's). In accordance with directives of the Higher Level Economic Conference, a decision has been made by the executive committee on developing AES and AST construction programs in CEMA member countries to the year 2000.

Introducing nuclear sources for generating electric energy and heat will lead to expansion of the industry's fuel base. In this respect, the development of fast-neutron reactors acquires particular significance.

At present, in the USSR, a prototype industrial AES with reactor BN-350 [fast-neutron nuclear power reactor of 350 megawatt capacity] is operating in the city of Shevchenko, and a BN-600 is operating at the Beloyarsk [or Beloyarskiy] AES.

In the next decade, efforts in the USSR will be centered upon reactor BN-800, which is, essentially, a modification of BN-600, and development of the next generation--BN-1600, combining great economy in electric energy production and good nuclear-fuel breeding characteristics.

Many CEMA member countries are interested in fast reactors. Therefore, cooperation among the brother countries already has been developing in this matter for 13 years. Joint activity permits accelerating the development of large, economical, industrial kinds of power equipment. Specialists of the NRB, VNR, GDR, PNR, SRR, USSR and CSSR are taking part in this work.

Attaching great significance to it, CEMA member countries, in 1980, signed an agreement on scientific and technical cooperation. Conducting both physics and thermohydraulics research and research on safety, and developing certain kinds of equipment and instruments through joint efforts, are envisaged by the cooperation program. A number of important results has been obtained in the course of carrying out the program. In the CSSR, for example, modular-type steam generators for fast-neutron reactors have been manufactured. In other CEMA member countries, the accessories and industrial instruments for checking on impurities in sodium, and many other kinds of the latest equipment, have been developed.

IV

As is well known, the development of the atomic power industry is inseparably linked to improvement in the fuel cycle.

Here, the cooperation of CEMA member countries is concentrated upon radiochemical reprocessing of irradiated fuel, its transporting, and processing and burying waste materials. It is aimed at further increasing the industry's economizing, concentrating waste materials, and ensuring maximum radiation safety.

The fact is, that the planned scales of AES construction will give rise to the need for transporting a substantial quantity of spent fuel. In this regard, the cooperation of CEMA member countries has, as its purpose, both the creation of special means of transport, and the development of standard international legal documents regulating transport matters.

At present, a great deal of work has been done on designing and standardizing these means, and on creating special packaging outfits for safe transport of spent nuclear fuel from AES's with VVER-type reactors. These meet the requirements for mechanical and thermal stability, airtightness, and radiation and nuclear safety. The technical conditions for gathering up TVEL's [fuel elements] from AES's with VVER-440 for transport by railroad or waterway also have been prepared.

An important result of the cooperation--the Regulations for Safe Transport of Spent Nuclear Fuel from AES's.

In CEMA member countries, the problems of providing AES's with fresh fuel, and its subsequent reprocessing, are resolved by agreement of the parties. The Soviet Union carries out the isotopic enrichment of uranium, manufactures and delivers to the countries concerned the heat-releasing [fuel element] assemblies for AES's, and accepts the spent nuclear fuel for regeneration. This is economically advantageous to all participating countries, and permits ensuring concentration of the highly [radio]active waste materials in a limited number of places.

Efficient and safe detoxification of radioactive waste materials formed in the process of AES operation is the determining factor in accelerated development of the atomic power industry. Therefore, research in the area of processing and burying radioactive waste materials occupies, today, one of the important positions in the brother countries' cooperation. A number of methods documents has been prepared by the commission for successful solution of this problem.

Great attention is devoted to burying radioactive waste materials in geological formations--surface strata; deep, water-saturated beds; and salt formations. Extensive theoretical, laboratory, field and experimental industrial research has been conducted along these lines. The fundamental designs of underground depositories, taking into account a region's hydrogeological conditions and the composition and volume of the waste materials, have been developed. On the agenda is preparing standard technological plans for detoxifying the radioactive waste materials of AES's with VVER-440 and VVER-1000, ATETs's and AST's, and developing industrial equipment for processing, hardening and burying these.

V

The commission devotes great attention to the development of nuclear instrument making. Within its purview, an analysis has been made of the state of the devices' development and production prior to 1980, and the trends to 1990, and proposals have been prepared for selecting a uniform, mainline modular system. Work has been organized on obtaining the devices for monitoring and controlling power reactors, monitoring AES radiation safety, and others.

By commission decision, all CEMA materials and standards for nuclear physics instruments, medical devices, KAMAK [not further identified] system units (modules), etc., are to be sent to the Interatominstrument MKhO for the organization of specialized production.

Steps, aimed at ensuring the radiation safety of nuclear power installations, are being taken within the multilateral cooperation's framework. Uniform criteria for optimatizing the amount of dosimetric monitoring of the environment in the vicinity of an AES location, as well as at the burying sites for radioactive waste materials, have been agreed upon. The effect of AES emissions and discharges on the radiation situation in large ecological systems is being studied in detail. Results of the research attest to the high degree of AES safety.

The legal bases of safe atomic energy use are being strengthened. Cooperation in this area is receiving steady development among CEMA member countries, as well as between them and other countries and international organizations, which is appropriate to the open character of the Council for Mutual Economic Assistance [CEMA].

Showing a readiness to share many years of experience and knowledge in AES operation, the countries of the socialist alliance are taking an active part, on the basis of equal rights and mutual benefit, in the work being done within the framework of the MAGATE [International Atomic Energy Agency] and other international organizations, and are rendering technical assistance to developing countries. Their motto--Atomic energy should work for creation.

An important direction in the commission's work is the organization of scientific and technical cooperation. At its 34th session (1978), TOKAMAK [not further identified] installations were proposed as the base for CEMA member countries' cooperation in the area of controlled thermonuclear fusion. In November 1979, a program of work for 1980-1990 was adopted. In accordance with it, five bilateral agreements have been signed to date, between the USSR State Committee for Utilization of Atomic Energy and corresponding organizations of the NRB, VNR, GDR, SRR and CSSR. They envisage the uniting of efforts along three lines:

Carrying out scientific research work on existing TOKAMAK installations;

developing, manufacturing, installing and adjusting the separate subassemblies and systems of the TOKAMAK-15 [not further identified] complex, and carrying out joint research on it;

preparing prospective designs of TOKAMAK thermonuclear reactors.

Work on the TOKAMAK-15 is part of the overall INTOR [not further identified] international program for producing the technical design [construction blueprint] for an experimental thermonuclear reactor.

VI

From the very beginning of its work, the commission has attached major significance to applying the achievements of atomic science and technology, not only to the power industry, but also to other national economy sectors.

Already at the commission's first session, in October 1960, decisions were made about organizing cooperation in nuclear instrument making, and in making and applying radioisotopes; and agencies were created, within the purview of which substantial work has been done on uniformity and standardization. Great attention also was devoted to developing specialization and cooperative amalgamation in production.

An important direction in the commission's activity is analyzing ways for effective application of radioisotopic methods and instruments in metallurgy, machine building, geology, construction, the gas and oil producing and refining industry, the chemical industry, gas and oil transporting; the paper, textile, leather, food, and pharmaceutical industries; agriculture, and other industries. Much has been done both for developing and introducing into these industries a wide range of radioisotopic devices for monitoring technological processes.

This has permitted obtaining substantial savings in raw materials, materials and energy, achieving an increase in equipment productivity and product quality, improving working conditions and production know-how, and shortening recovery periods for capital investments. On the whole, the economic impact for 1960-1985, throughout the CEMA member countries, is appraised at approximately 25 billion rubles, with expenditures on development and introduction on the order of 4.5 billion rubles.

The work carried out within the commission's purview has furthered acceleration of the introduction of progressive technologies and devices.

In the NRB, for example, the method of preplanting irradiation of seeds is being applied on a statewide scale for a number of leading grain, vegetable and fodder crops, which permits increasing the yields of tomatoes, peppers, eggplants, corn and alfalfa, and increasing their nutritive value. Various radioisotopic monitoring and control instruments for technological processes have been developed and tested under production conditions, including an automatic, modular microprocessor system with a neutron moisture meter, which makes it possible to automate control over the manufacture of concrete mixtures, improve their quality, and reduce the amount of cement used. In all, about 2,200 units of radioisotopic equipment for various purposes are being operated in the NRB's national economy.

In the VNR, radioisotopic monitoring and control equipment is installed in more than 1,500 technological branches of industrial enterprises. Series production of high-performance medical equipment has been organized.

In the GDR, over 14,000 radioisotopic instruments are in use. Their annual augmentation amounts to approximately 15 percent. A mobile measuring system for radioactive tracer investigations of technological parameters has been developed, and is being used successfully under industrial conditions. A radiometric system for determining the ash content of coal has begun to operate, for the first time in practice, on a prototype conveyor of the TES in (Hagenwerder). With its help, they are succeeding in maintaining the amount of heat being produced per unit of time at a constant level, and thus in optimatizing the process of burning coal and reducing its losses, and in increasing the equipment's k.p.d. [useful operation coefficient].

In the PNR, a variety of radioisotopic equipment for determining level, moistness, density, thickness, weight, concentration, and composition of various substances and materials is being developed and put into series production. Mobile laboratories for industrial radiometric measurements are being used successfully.

In the SRR, the ROKhA-6 roentgenofluorescent substance-composition analyzer, radiometric systems for determining the moistness and heat-producing capacity of coal at a TES, and instruments for determining degree of wear in the linings of blast furnaces have been developed.

In the USSR, a large number of radioisotopic devices has been introduced, ensuring speed, accuracy and continuity of the measurement and automatic monitoring of basic parameters in a wide range of technological processes in the mining, chemical, light and food industries, metallurgy, construction, machine building, etc. A new technology for the radiation modification of wood, natural and synthetic fibers and fabrics, and polymeric and rubber-technology materials has been created. The methods have been fully developed, and the technology optimatized, for radiation processing of produce, which permits achieving substantial increase in the yield of farm crops and the spoilage-protection of raw foods.

In the CSSR, about 5,000 radioisotopic instruments and assemblies have been installed at industrial enterprises. Up-to-date models of accelerators and flaw detectors have been introduced, and the radiation-technology processes for modifying wood and abrasive materials have been mastered.

In all CEMA member countries, the methods and equipment of radioisotopic diagnostics are being applied successfully in medicine, and radiation therapy is being carried out for malignant tumors. In the VNR, GDR, PNR, USSR, and CSSR, the essentially new technology of radiation sterilizing materials and manufactured articles for medical purposes is being applied on industrywide scales, providing for an excellent effect and the full automation of production.

Modern isotopic radiation equipment, coupled with EVM [electronic computer] and microprocessor equipment, constitutes an important trend in scientific and technical progress. Use of these on extensive scales furthers the effective solution of pressing socio-economic development problems.

Forecasting has an important place in the commission's activity. In 1974, the Joint Forecast of CEMA Member Countries' Nuclear Power Industry Development to the Year 1990 was examined and approved by it. This forecast was used in developing a concept of the further development of CEMA member countries' fuel and power base. In 1983, the Forecast of the Development of Basic Directions in the Application of Isotopes and Radiation Equipment in the National Economy to the Year 2000 was approved. At present, a forecast of the technical improvement of VVER-type atomic power installations is being developed.

Ten most important problems, including about 60 subjects, engross scientific and technical cooperation. Some 120 organizations have been recruited for their solution.

At present, the commission is concentrating its attention on carrying out the tasks stemming from decisions of the CEMA Member Countries' Higher Level Economic Conference. This is a matter of changing the structure of power production, and predominant development of the atomic power industry.

Major problems confront the commission in connection with preparing the Comprehensive Program of Scientific and Technical Progress for 15-20 Years, especially its third priority direction--accelerated development of the atomic power industry. The efforts of CEMA member countries and agencies will be aimed at intensive augmentation of power capacities with familiar types of nuclear reactors, and, to this end--at steady introduction of the atomic power industry into the sphere of household and industrial heat supply, development and improvement of all elements of the fuel cycle, and ensuring safe conditions for using atomic energy.

Being an important factor in further progress of the brother countries' economies, the atomic power industry is urged to make a worthy contribution to solving basic problems of the current stage in socialist and communist construction.

Czech-Soviet Cooperation in AES Equipment Production

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 9, Sep 85 pp 21-25

[Article by Stanislav Gavel, chairman of the Czechoslovak Commission for Atomic Energy; and Ladislav Molnar, first deputy chairman of the Czechoslovak Commission for Atomic Energy; under the rubric "Integration in Action": "The Nuclear Power Industry: Czechoslovak-Soviet Cooperation"]

[Text] Close cooperation with the Soviet Union in the field of nuclear research has given Czechoslovak scientists, designers and technicians an opportunity to participate in the development of the nuclear power industry since practically its very origin. In April 1985, it had been 30 years since the day of signing the Agreement on the Granting of Technical Assistance to the Czechoslovak Republic by the Union of Soviet Socialist Republics in Developing Research on the Atomic Nucleus, and Using Nuclear Power for the National Economy's Needs. It is noteworthy that the agreement was concluded 1 year after the first atomic electric power plant in the world was brought into operation in the city of Obninsk, near Moscow. This is an excellent example of socialist internationalism's principles in action.

Scientific Research and Technical Base

The Soviet Union gave us assistance as early as during the constructing and equipping of the Institute of Nuclear Physics (today the Institute of Nuclear Research) in the city of (Rzhezh), near Prague, having furnished the basic experimental equipment for it--a research reactor (VVR-S) [water-moderated, water-cooled, non-power nuclear reactor, subtype "S" (Subtype not further identified)], a cyclotron, measuring devices, etc. The Soviet Union also gave us assistance in training specialized personnel. A department of technical and nuclear physics was established in 1955 at Karlova [Charles] University in Prague, but the first Czechoslovak undergraduate and graduate students were sent to the USSR.

In the course of implementing the first intergovernmental agreement between the USSR and the CSSR [Czechoslovak Socialist Republic] in the area of using atomic power for peaceful purposes, not only was substantial assistance provided in creating the Czechoslovak scientific research base, but the foundations also were laid for developing the national nuclear power industry and using radionuclides and ionizing radiation in all areas of the national economy.

The Agreement Between the CSSR and USSR on Constructing the A-1 Atomic Electric Power Plant with Gas-Cooled Reactor, concluded in 1956, was a further step in this direction.

On the threshold of the 1960's-1970's, after reappraising the development concept for the Czechoslovak nuclear power industry, the Intergovernmental Agreement on Cooperation in Constructing Four Units [Bloka] of VVER-440 [440 megawatt water-moderated, water-cooled nuclear power reactor] at the (Yaslovske Bogunice) AES [nuclear electric power plant] was concluded between our countries. Later, similar agreements were concluded on constructing the (Dukovany) and (Mokhovtse) AES's (four units of VVER-440 each). Recently, an agreement has been signed for constructing a (Temelin) AES with four units of VVER-1000 [1,000 megawatt water-moderated, water-cooled nuclear power reactor].

A memorable year for Czechoslovak industry was 1974, when, on the basis of a Soviet Union proposal, we concluded with it the Intergovernmental Agreement on the Specialization and Cooperative Amalgamation of Equipment Production for Atomic Electric Power Plants. It became the basis for developing long-term production programs at a number of large Czechoslovak machine-building, metallurgical and electrical-engineering enterprises. A new industry is arising in our economy's structure--nuclear-power-industry machine building. In the CSSR, the production capacities have been created, and the industrial production of selected components of the primary and secondary loops [kontura] for AES's with water-water [water moderated, water cooled] reactors has been mastered, at the Skoda-Plzen, (Vitkovice), and Sigma-Olomouc Enterprises, the Slovak Electric Power Machine-Building Plants in the city of (Tlmacha), etc. Along with the USSR, Czechoslovakia has become a large producer and supplier of basic equipment for the AES's being built in CEMA member countries.

This was reflected, as well, in the Agreement of CEMA Member Countries and the SFRY [Socialist Federal Republic of Yugoslavia] on Multilateral International Specialization and Cooperative Amalgamation in Production and Reciprocal Deliveries of Equipment for Atomic Electric Power Plants for the Period 1981-1990, signed by representatives of the governments of the NRB [People's Republic of Bulgaria], the VNR [Hungarian People's Republic], the GDR [German Democratic Republic], the PNR [Polish People's Republic], the SRR [Socialist Republic of Romania], the USSR, the CSSR, and the SFRY. This document specified the divisions of labor among the countries involved for supporting the planned construction of atomic electric power plants with the necessary equipment--an important condition for development of CEMA Member Countries' United Power Systems.

For the purpose of creating conditions for the planned development of the nuclear power industry in the CSSR in the 1980's, the Program of Cooperation Between the CSSR and the USSR in the Area of Developing the CSSR Nuclear Power Industry to the Year 1990 was adopted by the CSSR and USSR Governments. Cooperation within its framework is directed toward using the Soviet Union's technological aid in developing Czechoslovakian nuclear energy. Moreover this will take place not only in building nuclear power equipment and in the effective use of existing production capacities and in supplying the Czechoslovakian atomic power stations under construction with nuclear fuel. Our countries attach great significance to this joint program; deputy heads of the governments of the CSSR and USSR are following the course of its development. In accordance with the program, 12 VVER-440 nuclear power units are being constructed in the CSSR at the (Yaslovske Bogunice), (Dukovany), and (Mokhovtse) AES sites, and the construction of 4 VVER-1000 nuclear power units has begun at the (Temelin) AES site.

The work on long-term economic development, and preparation of the Five-Year National Economic Plan for 1986-1990, speak clearly of the fact that the nuclear power industry also will occupy a prominent position in the CSSR energy balance in the future.

Role of the Nuclear Power Industry

The nuclear power industry's share in meeting Czechoslovak demands for natural energy resources constitutes about 3 percent at present, and should increase to at least 15 percent before the year 2000. At the same time, it is necessary, in the 1990's, to create the preconditions for building nuclear power industry production capacities on a scale that will permit increasing nuclear energy's share in meeting Czechoslovak demands for primary energy resources to 28-30 percent by the year 2010. Nuclear electric power plants' share in electric energy production in the CSSR exceeds 13 percent at the present time, and it should reach 30 percent in 1990, and over 50 percent in 2000. Moreover, the rapid growth in electric energy generation at nuclear electric power plants is intended not only to cover increases in electric energy production, but also to replace a large part of existing electric energy production at thermal electric power plants [TES's] being phased out. Due to the development of nuclear electric power plants [AES's], fossil-fuel electric power plants' share should be reduced from 85 percent in 1980 to 35 percent in 2000. It should be noted that not a single coal-burning thermal electric power plant has been built in the CSSR during the current five-year period. All of this is showing up favorably in lessening the power industry's harmful effects on the environment.

At present, 3 VVER-440 units are in operation at the (Yaslovske Bogunice) AES, and 1 at the (Dukovany) AES, with the overall electrical capacity of 1,760 megawatts. Start up of the fourth unit at the (Yaslovske Bogunice) AES still is expected this year, while bringing the final, fourth unit into operation at the (Dukovany) AES is planned for 1987. At the (Mokhovtse) AES site, the plant is being constructed for the main production unit, in which reactors of 440 megawatt capacity will be installed. The first of these should be brought into operation in mid 1989, and the others at 9-month intervals. The average rate of bringing VVER-440 units into operation at these sites amounts to about 1.1 year per unit during 1979-1992.

After 1990, and the end of the 12 VVER-440 units' construction, it is planned to provide for increase in Czechoslovak AES capacicities by constructing power units with VVER-1000. Start up of the first such unit, at the (Temelin) AES, is envisaged at the end of 1991, and one of the next three units each year and a half thereafter. Work is proceeding on selecting the construction site for yet another AES with VVER-1000.

Thus, by 2000, it is planned to have in the Czechoslovak energy system 12 units with VVER-440 and 5 units with VVER-1000, for an overall capacity of 10,280 megawatts. This will permit the Czechoslovak nuclear power industry to produce over 56 billion kilowatt-hours of electricity per year, and provide for the extraction of about 6,000 thermal megawatts of heat from the AES's.

Atomic Heat Supply

Development of the nuclear power industry also will affect the structure of the Czechoslovak heat supply, which will be using extracted AES heat. The means of building atomic heat supply plants--AST's--are under consideration (One 500 megawatt unit--even before 2000). According to plans, the nuclear power industry should be meeting about 0.3 percent of the country's requirements for heat in 1990, and at least 3-4 percent in 2000. All nuclear power units built in the CSSR will be equipped with turbine assemblies for extracting heat, which is to be delivered by heat mains to nearby industrial and urban complexes in the form of hot water.

The first Czechoslovak heat line of this type already is being constructed, from the (Yaslovske Bogunice) AES to the city of Trnava. It consists of 2 pipelines of 700 millimeter diameter, its length is 23 kilometers, and its heat capacity is 250 megawatts. Its construction is planned to be completed in 1986. Later on, a heat line will extend to the cities of (Glogovtsa) and (Pyeshtyani). Plans have been developed for supplying heat to the city of Brno from the (Dukovany) AES. Heat from the (Mokhovtse) AES will be supplied to the cities of Levice, Nitra, and (Tlmache). It is planned to supply the city of Ceske Budejovice area with heat from our first power plant with VVER-1000 units at the (Temelin) AES. Units of 1,000 megawatt capacity will be equipped with 1,000 megawatt turbines, providing for the extraction of 900 megawatts of heat with 3-stage heating of hot water to 150 degrees Celsius. Selection of construction sites for VVER-1000 power units in Eastern Slovakia, Eastern Czechia [Bohemia], and Northern Moravia will be carried out taking heat-supply prospects into consideration.

The experience of the Soviet Union in constructing AST's [nuclear heat supply plants] for supplying hot water to the cities of Gorkiy and Voronezh is being widely used in the construction.

Production Base

Implementation of the Czechoslovak nuclear program presents new demands upon the domestic production base of atomic machine building and the metallurgical, machine-building and electrical-engineering industries. Today we may note with satisfaction that our industry, thanks to the many years of Czechoslovak-Soviet cooperation, can provide 80 percent of all deliveries of primary and secondary loop [kontur] equipment for VVER-440 power units. The main attention now is being devoted to preparing for the production of equipment for VVER-1000 units, which must become the base for the nuclear power industry in CEMA member countries after 1990. Thus, the Skoda-Plzen concern is preparing for production of the VVER-1000, the turbine, and the separator-preheater for the turbine; the (Vitkovice) concern--the steam generator and volume compensator; the Sigma-Olomouc concern--the feed and prefeed pumps for the turbine, the high-speed gate valves, and the pipes; the (ChKD Dukla)-Prague Enterprise--the deaerator and feed tanks, and the condensate equipment; and the Czechoslovak Fan Plants--the filtration equipment, the air heat exchangers, and the fans.

In later years, Czechoslovak nuclear machine building's share in the deliveries of reactor units for CEMA member countries will constitute approximately 25 percent. At present, five type V-213Ch VVER-440's, manufactured by the Skoda-Plzen concern, already are in operation: two reactors at an AES [or at AES's] in the VNR, and three in the CSSR. Czechoslovak reactors are being installed in the VNR and GDR. Production of the equipment for 14 complete reactor assemblies for the CSSR, VNR, GDR and PNR has been set in motion at this concern.

It attests to the importance we attach to nuclear power industry matters that the first, and the most extensive, program developed for the Eighth Five-Year Plan (1986-1990) is the State ad hoc program "Development of the Nuclear Power Industry to the Year 2000."

Together With Our Soviet Partners

The contribution of the agreement on the Soviet Union's offer of assistance to Czechoslovakia in developing and investigating the physics of the atomic nucleus, and in using nuclear energy for national economic purposes, was stressed at the beginning of the article. That agreement, and also the subsequent agreements and treaties concluded at various levels in the course of the past 30 years, have furthered formation of the Czechoslovak scientific-research, experimental-design and production base, its structure and scope permitting it to be included effectively in the CEMA member countries' joint nuclear program. Thousands of scientists and specialists, and dozens of scientific-research organizations participate in this work.

The cooperation with our Soviet partners is developing in close connection with CEMA member countries' multilateral cooperation in the reactor science and technology field being organized by the CEMA Permanent Commissions for Cooperation in the Area of Using Atomic Energy for Peaceful Purposes and in the Area of Electric Power. The CSSR actively participates in the work of these commissions, and also attaches great significance to integrating activity of the international economic associations [MKhO's] Interatomenergo [International Economic Association for Cooperation in the Production of Nuclear Power Plants] and Interatominstrument [International Economic Association for Cooperation in Nuclear Instrument Making].

Within the framework of the Long-Term Ad Hoc Program for Cooperation in Energy, Fuel and Raw Materials, two agreements were concluded in 1980, at the level of the CSSR State Commission for Scientific and Technical and Investment Development and CSSR Federal Ministry of Fuel and the Power Industry on the one hand, and the USSR State Committee for Utilization of Atomic Energy (GKAE) and USSR Ministry of Power and Electrification on the other, for cooperation in mastering power units with VVER-1000, and developing large-capacity fast-neutron reactors.

Valuable results have been obtained over the past 5 years of their practical implementation, and a number of jobs has been let out on a contractual basis. In 1983, a procedure was adopted, by which proposals for the specialization and cooperative amalgamation of production of the AES components being jointly developed under the aforenamed agreements are presented by the CEMA Permanent Commissions for Cooperation in the Area of Using Atomic Energy for Peaceful Purposes and the Area of Electric Power to the Intergovernmental Commission for Coordinating the Cooperation of CEMA Member Countries and the SFRYu in Producing Equipment for AES's.

Significance of NTP [Scientific and Technical Progress] and NTS [Scientific and Technical Cooperation]

The Czechoslovak side is confident that the Comprehensive Program of CEMA Member Countries' Scientific and Technical Progress for 15-20 Years, being developed in implementation of the Moscow Higher Level Economic Conference's decision, will become a new qualitative leap forward in the brother countries' multilateral cooperation. As is well known, one of its five priority directions is accelerated development of the atomic power industry. The program should effectively further the consistent and purposeful union of scientific and technical cooperation with production and economic activity, encompassing the entire science-technology-production-application cycle.

The scientific and technical cooperation of Czechoslovak organizations in the nuclear power industry area is developing under the auspices of several departments--the Czechoslovak Commission for the Atomic Power Industry (ChSKAE), the Federal Ministry of Metallurgy and Heavy Machine Building, the Federal Ministry of Fuel and the Power Industry, and others. Thus the cooperation of the ChSKAE and the USSR GKAE encompasses, first of all, the following basic

areas:

Water-moderated, water-cooled reactors--investigation of transient thermohydraulic processes and physical characteristics of the reactors and the materials of the reactor vessels;

fast reactors--thermophysical investigation of the core, complex calculations for power reactors, and development of fittings and steam generators;

radioactive waste materials--processing AES waste materials by hardening, and processing hard waste materials by incineration.

In direct scientific and technical cooperation between the CSSR Federal Ministry of Fuel and the Power Industry and the USSR Ministry of Power and Electrification, there are solved, for example, problems of mastering and operating AES's with VVER's; specifically, ensuring the equipment's quality of installation and operation, increasing effectiveness of the monitoring and control system, improving technical and economic indicators, studying plant manipulation characteristics, using automated control systems, and developing standard start-up programs.

The scientific and technical cooperation between the CSSR Federal Ministry of Metallurgy and Heavy Machine Building and the USSR Ministry of Power Machine Building is aimed at solving direct production problems, such as developing future directions in investigating reactor materials, automated anticorrosion-layer plating on inner surfaces of the VVER-1000 vessel's pipe couplings, improved technology for producing VVER-1000 vessel covers without using submerged-arc welded joints, methods for evaluating and checking materials and designs, technology for producing the rolled and welded drums for steam-generator shells, modernizing production of large steel castings for power industry machine building, etc.

The Soviet Union is the main designer and general planner for all atomic electric power plants built with its technical assistance in CEMA member countries. Therefore, scientific-research and experimental-design work in the CSSR is done in close liaison with the Soviet lead organizations.

Prospective Areas of Cooperation

In concluding, we should like to mention those areas, where, in our view, it is advisable to extend Czechoslovak-Soviet cooperation even farther. First of all, this means completing the development and mastering the production of equipment for AES's with VVER-1000.

At the same time, the technical and economic parameters of AES's with the VVER-440 should be further improved; first of all, by increasing the fuel's burning depth with a more uniform neutron flux in the core.

Great importance is attached to increasing the safety and reliability of components in AES primary and secondary loops [kontura]. This is a matter of reducing the neutron flux in the reactor vessel's walls, means for restoring the vessel after its embrittlement, and increasing the corrosion resistance of certain steam-generator parts. It is important, also, to improve the measurement and control systems on the basis of microprocessor technology.

The cooperation should be broadened, in our view, in such areas as methods improvement and equipment development for production and operational monitoring of the materials in components functioning under conditions of radiation, high pressure and temperature; solving the problems of radioactive waste materials arising in AES operation, and the means for compact storage of spent fuel in AES storage spaces; technology of fast reactors, and development of selected components for fast reactors having liquid-metal cooling.

The task of preparing technical and economic supporting documentation for heat production from nuclear sources for centralized public heat distribution, and resolving, in connection with this, the question of Czechoslovak industry's participation in the production of equipment for AST's, also is extremely urgent.

In the area of standardization and normalization, it is necessary to continue the work on MKhO Interatomenergo's program aimed at establishing uniform technical standards and requirements for the production and operation of power industry equipment, fittings, instruments, and materials for AES's, which are subjects of the agreement on specialization. It also is important to develop further the program of work on creating normative and technical documentation for planning, constructing, fitting out, and operating AES's.

We should expand and broaden cooperation, also, in developing standardized designs for VVER-1000 power units, and introduce computer technology into the process of preparing for and constructing AES's.

Czechoslovak-Soviet cooperation in the nuclear power industry is a shining example of successfully developing mutual relations based upon the principles of further broadening and improving socialist economic integration, an example reflecting the reasonable aspiration of the CSSR and USSR, and all the brother countries, to bring about a condition in which nuclear power will be used throughout the world exclusively for peaceful purposes.

12319
CSO: 5100/5

USSR

CUBAN, OTHER CEMA SPECIALISTS RECEIVE AES TRAINING AT USSR SITE

Moscow IZVESTIYA in Russian 20 Jun 85 p 1

[Article by A. Blokhnin, IZVESTIYA special correspondent, Energodar, Zaporozhye Oblast: "How They Teach AES Construction"]

> [Text] A group of Cuban specialists has arrived at the instructional center for training personnel in the construction of atomic power stations. This center has been created in Energodar under the construction administration of the Zaporozhskiy AES [atomic power station]. After receiving on-the-job training at the instructional center and directly at the ZAES facilities, they will work on building an atomic power station in their own country, where a large AES is being built at the site in Huragua with the technical assistance of the USSR.

I. Khalyavka, an expert in production training, conducts a short instructional session, and I occupy the work station of the tower crane operator. Under my left foot is the contact pedal. On the sides of the chair are two levers. Forward-reverse... The boom raises and lowers smoothly and the cargo hook slides up and down easily. And now the crane itself, stretched out before the trainer chair in all its three-meter height, moves along the rails.

Alongside we see the flashes of the electric welding and hear the characteristic din of the welding transformers. But the "electrodes" are not reduced in size no matter how hard the trainees try. This too is a simulation.

This is merely an example of the rich arsenal of the technical means of instruction which the Energodar center has at its disposal. There is a programmed instructional machine developed by specialists at the Kiev Engineering-Construction Institute--KISI. (The trainees prefer to call it simply "kisa"). There is a graph projector, a video recorder, and various electrified mnemoschemes...The theoretical instruction in the classrooms is intertwined with practical work in the shops. The course concludes with a mandatory in-service training period directly at the facilities of the AES under construction.

"Soon after work began at the construction site of the Zaporozhskiy Atomic Power Station," says Deputy Director of Construction Administration A. Reutov,

it became apparent that we cannot do without the well-organized specialized training of workers. And so this center was developed. Our hopes have been fully justified. The graduates of the instructional center work with assurance and stability. The personnelturnover is less than 3 percent..."

"Before I worked in a vocational-technical school," says instructor A. Polivanaya. "At first here at the instructional center I could not get used to the fact that the training time is extremely short--only 6 months. Yet in this time the trainee receives not only a superficial knowledge, but goes off to the construction site with the certification of a qualified specialist--of the third, fourth, and sometimes even fifth grade."

"The active combination of technical means with a system of so-called 'problems training'," continues instructional center Director K. Chaykina," helps us to achieve this effect. We try to teach the future specialist to think logically and to achieve an in-depth mastery of the profession."

The present instructional center in Energodar is a modern complex equipped with 18 classrooms, a library with reading hall, and production training shops with an area of 1,200 square meters. A dormitory has been built for trainees coming to Energodar from other cities. It has an excellent sports gymnasium. The instructional center in Energodar has been awarded the certificate of the AUCCTU and Goskomtrud [State Committee for Labor and Social Problems] for its exemplary organization of training personnel for atomic power stations under construction. It has been recognized as the best professional training institution in the USSR Ministry of Energetics and Electrification.

It is therefore no accident that Energodar has been selected as the site for training foreign specialists. The Cubans were the first to come to the shores of the Kakhov Sea. Speaking with the group of center students who had just come from the Island of Freedom, I asked them their opinion of the professional training they received in the USSR.

"Before beginning our studies," says the group director and engineer Jorje Landaburo, "we had an extensive tour of all the construction facilities of the Zaporozhskiy Atomic Power Station. The scope of construction and the bold engineering decisions are impressive. There is no company in the world which is brave enough to undertake construction of such large atomic power units--one million kilowatts!--using the conveyer method. We would like to borrow this experience and try to apply it in our country..."

Power engineering specialists from Bulgaria, Czechoslovakia and Mongolia come to Energodar to study.

The flow-line construction of the Zaporozhskiy atomic giant is a general test of the capacities before the introduction of this form of high-speed construction at other similar facilities. And although the construction of the foundations for the fifth "million kilowatt unit" has only now begun at the ZAES site, the construction managers are already thinking of a new flow-line at the Chigirinskiy AES, which will be built in the neighboring, Cherkasskaya Oblast. As before, the instructional center ties its plans in closely with the prospective needs of construction.

12322
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ITALY

CRAXI URGES CREATION OF EUROPEAN NUCLEAR FORCE

AU262009 Rome ANSA in English 1930 GMT 26 Dec 85

[Text] (ANSA) Rome, December 26 -- In view of Spain's entry January first into the European Economic Community as a full-fledged member, Italian Premier Bettino Craxi gave a wide-ranging interview to Spanish television, touching on such areas as efforts to achieve greater internal balance within the EEC, closing the gap between the economies of the various members and the harmonization of regulations and institutions on the old continent.

In the interview, which will be beamed on Spanish television screens this evening, Craxi said that we live in an age when everything moves faster than before and that, therefore, many obstacles can now be overcome faster than before. "Therefore", he said, "on the whole I can say I am optimistic".

He said that conditions within the Community not only differed from country to country, but above all, from region to region. Thus, one of the historic goals of the Community has been to create a greater harmonization within. Moreover, Europeans must take a larger view and not concern themselves with Europe alone, he cautioned. He said that from a political point of view, the tendency had been for each European nation to play its own role on the international stage. However, this did not mean that Europeans as an entity did not exist, he said. They exist and they are the sum total of European nations that manage, sometime, to play a certain role, Craxi lent on.

As to security in a nuclear age, the Italian premier said that the problem had been solved for the time being through the alliance among the Western nations. However, he urged Europe to begin an entirely new path bent of creating its own nuclear force. He urged a concentration of efforts and cooperation in the fields of science and technology. He said that the technological gap between Europe, Japan and the United States must not be allowed to grow larger.

Craxi stressed that the Atlantic alliance was and must remain on an equal-footing basis with all nations working together for world peace.

The European Community, which as of January first will become a Community of twelve with the entry of Spain and Portugal, must move forward together in the year 1986 and he voiced confidence that Spaniards would be well in tune with those working for such progress.

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